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DECOUX (L.), VANDERWAEREN (J.), & ROLAND (G.). **La valeur de la désinfection des glomerules de Betteraves.** [The value of Beet seed-cluster disinfection.]—*Sucr. belge*, lv, 7, pp. 130–134; 8, pp. 145–152, 1935.

The results [which are fully described] of laboratory and field experiments in beet seed-cluster disinfection against black leg (*Phoma betae*, *Pythium de Baryanum*, and *Aphanomyces levis*) [*R.A.M.*, xv, p. 190], supplemented by a study of the relevant literature, indicate beneficial effects under local conditions from treatment of the I-Rimpau and II-Sandomiersko varieties with tutan or germisan, but owing to the relative unimportance of the disease in Belgium, the practical utility of the process is questionable.

SCHMIDT (E. W.). **Notizen zur angewandten Botanik. I. Über das Verhalten von verschiedenen Cercospora beticola Herkünften und über künstliche Infektion mit diesem Pilz.** [Notes on applied botany. I. On the behaviour of various collections of *Cercospora beticola* and on artificial infection by this fungus.]—*Angew. Bot.*, xvii, 6, pp. 445–453, 10 figs., 1935.

The ten strains of *Cercospora beticola* [*R.A.M.*, xv, pp. 191, 193] isolated from dried beet leaves in Germany (two strains), Austria, Italy, Holland, Hungary, Rumania, United States, Spain, and Japan, and grown in pure culture on a beet decoction-agar medium with 2 per cent. cane sugar, all produced the typical leaf-spot symptoms on the plants into which they were inoculated, and spore formation on the latter was normal in character and extent. There is thus no question of physiologic specialization within the species. In this connexion it is pointed out that the mycelial growth of the strains varies with the medium [ibid., vii, p. 694], of which the sugar-content particularly affected the colour of the colony, high sugar concentrations causing the formation of a bright red pigment. In addition to the species of *Chenopodium* already reported as susceptible to infection by *Cercospora beticola* [loc. cit.], *Amaranthus retroflexus*, *Atriplex hastata*, and *A. hortensis cupreata* contracted leaf spot as a result of inoculation. On the leaves of the last-named host, which normally appear deep red in consequence of their high anthocyanin content, the spots induced by *C. beticola* appear light green—probably an indication of a change in the reaction of the cell sap from acid to alkaline under the influence of the parasite.

DOERELL (E. G.). **Borax bzw. Borax-Superphosphat als Schutzmittel gegen Herz- und Trockenfäule der Rüben (Sommer 1935). Erfahrungen und Beobachtungen mit der Anwendung.** [Borax or borax-superphosphate as a prophylactic against heart and dry rot of Beets (summer 1935). Experiences and observations on its applications.]—*Dtsch. landw. Pr.*, lxii, 49, pp. 599–600, 1935.

The writer briefly summarizes the results of his observations in Czecho-Slovakia during the summer of 1935 on the control of heart and dry rot of beets [*R.A.M.*, xv, p. 189], from which it appears that the prophylactic value of borax is greatly enhanced by the simultaneous incorporation with the soil of superphosphate in a ratio of 1: 10 (20 kg. borax and 200 kg. superphosphate per hect.).

UPPAL (B. N.), PATEL (M. K.), & KAMAT (M. N.). **Pea powdery mildew in Bombay.**—*Bull. Dep. Agric. Bombay* 177 of *1935*, 12 pp., 3 pl., 7 figs., 4 graphs, 1935.

Pea powdery mildew (*Erysiphe polygoni*) [*R.A.M.*, xiii, p. 494; xiv, p. 287] often assumes epidemic proportions during January in Bombay Presidency where the conidial stage (the only one found) is generally seen as early as towards the end of November, and continues to spread until the advent of the hot season in April. The disease is very destructive in moist, warm weather, its most serious aspect being its attack on the flowers and pods. From November to January the maximum atmospheric temperature in Bombay generally ranges from 75° to 90° F., and it is during this period that infection reaches its maximum severity. As the daily temperature rises above 90° in March a set-back occurs in the development of the disease, which almost disappears in April and May.

In October, 1932, seed collected from diseased plants the year before was disinfected with mercuric chloride and sown in sterilized soil. Twenty days later 3 out of 5 plants showed the fungus on the leaves. In another similar experiment, out of 10 plants from the 1931 and 1932 seed 2 and 7, respectively, showed infection 45 days after sowing. This evidence suggests that *E. polygoni* is borne internally in the seed.

Twenty seeds from diseased plants were soaked in cold water for 6 hours and then exposed at 50° C. for 10 minutes. They were sown on 21st November, 1932, in pots, and on 3rd January, 1933, the first signs of mildew were noticed on control plants raised from untreated diseased seed, while the plants from the treated seed were still unaffected when the experiment was discontinued on 3rd February [ibid., vii, p. 70].

The weights of 307 healthy and heavily diseased seeds were, respectively, 66·8 and 21·1 gm. In two laboratory tests healthy seed gave 100 per cent. germination, while slightly and heavily diseased seed gave, respectively, 90 and 0 per cent.

One application of sulphur made during flowering gives complete control. The total dressing per acre need not exceed 25 lb., and the time required to dust this area amounts to about 2½ hours.

WALKER (J. C.). **A study of resistance to Fusarium wilt in Alaska Peas.**—*Amer. J. Bot.*, xxii, 10, pp. 849–857, 1935.

This is the full report of the author's investigation of the nature of

resistance to wilt (*Fusarium orthoceras* var. *pisi*) [*R.A.M.*, xiv, p. 148] in the resistant strain of the Alaska peas, an abstract from which has already been noticed from another source [ibid., xii, p. 412]. In addition to the information already supplied, the fact that the pea root rot fungus (*F. martii* var. *pisi*) [*F. solani* var. *martii* f. 2: ibid., xiv, p. 731], which is non-selective in its action, grew equally well on the extracts from fresh or dried roots of both the wilt-resistant and the wilt-susceptible strains of the Alaska pea suggests the existence in the wilt-resistant extract of some substance or substances inhibitive to the wilt fungus, possibly contributing to the resistance of that strain.

TASUGI (H.) & TAKATUZI (H.). **Nematosporangium aphanidermatum (Edson) Fitzpatrick on Phaseolus vulgaris L. in Nippon.**—*Ann. phytopath. Soc. Japan*, v, 3, pp. 245–264, 6 figs., 1935. [Japanese, with English summary.]

Beans (*Phaseolus vulgaris*) on a farm near Tokyo were found to be affected in 1930 by a cottony leak attributed to *Nematosporangium* [*Pythium*] *aphanidermatum* [*R.A.M.*, xiv, p. 498]. Good growth was made on a number of standard media, the most favourable being oatmeal agar, the temperature range for development extending from 10° to 40° C., with an optimum at 30°; mycelial production is most luxuriant at 20° to 24° and that of the oospores at 22° to 32°. The most suitable hydrogen-ion concentration for the development of *P. aphanidermatum* was found to be P_H 5·25 to 6·45, no growth occurring at 2·9. The pathogenicity of the fungus to bean pods, leaves, and seedlings was established by inoculation tests, in which it also infected the fruits of certain other Leguminosae, Solanaceae, Cucurbitaceae, and fig, as well as leaves and stems of the eggplant, *Datura fastuosa*, and various seedlings, the symptoms developing most freely at 27° to 34°.

HARRISON (A. L.). **Transmission of Bean mosaic.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.* 236, 19 pp., 2 figs., 1 diag., 1935.

A brief tabulated account is given of laboratory and field experiments and observations in New York State from 1932 to 1934 to determine some of the factors that govern the transmission of bean (*Phaseolus vulgaris*) mosaic [*R.A.M.*, xv, p. 274 and next abstracts], the variety Stringless Green Pod Refugee being used exclusively in the controlled experiments. In the neighbourhood of Geneva, New York, bean mosaic has not been found so far to occur on other leguminous hosts, with the exception of one plant of white sweet clover (*Melilotus alba*). Of the other legume mosaics present in the State the viruses of the red clover (*Trifolium pratense*), alsike clover (*T. hybridum*), white sweet clover, and black medick (*Medicago lupulina*) mosaics were repeatedly transmitted to bean by the pea aphid (*Illinoia* [*Macrosiphum*] *pisi*) but with great difficulty by mechanical methods, the disease so produced being very similar to, if not identical with, yellow bean mosaic [ibid., xiii, p. 488]. None of the other legume mosaics was transmitted either by the aphid or by hand inoculation.

In a series of experiments it was shown that the considerable variations (ranging from less than 20 to as high as 59 per cent.) observed in the transmission of the bean mosaic through the seed is explicable by

the fact that pods formed early on infected plants transmit the mosaic to a larger proportion of their seed (43 to 100 per cent. during the first 19 days from the date of first flowering) than those set during the later period of blossoming (0 to 25 per cent.). The virus extract obtained from diseased seedlings and young plants was shown to be more infective than that of plants in the flowering or fruiting stages. Further, the mosaic was also transmitted when the leaves of mosaic-free and of diseased bean plants were roughly rubbed together by hand in insect-proof cages or by wind from an electrical fan in the greenhouse.

Field observations indicated that the spread of bean mosaic is greatly reduced in fields or plots freely exposed to the wind, and that it tends to spread much more rapidly in areas close to clover and lucerne than in those farther removed from such crops.

HARRISON (A. L.). **The physiology of Bean mosaic.**—*Tech. Bull. N.Y. St. agric. Exp. Sta.*, 235, 48 pp., 4 figs., 6 graphs, 1935.

The experiments reported in this paper were carried out to determine the action of bean mosaic virus [see preceding and next abstracts] on the physiological activities of bean plants (Stringless Green Pod Refugee). It was first shown that exposure of mosaic-infected bean seeds to temperatures as high as 100° C. for several hours, to formaldehyde fumes for 16 days, and to the action of X-rays (from 1,000 to 32,000 R-units) failed to inactivate the virus or to eliminate the infected seeds. Attempts to differentiate healthy from mosaic-infected seeds by their specific gravity also failed to give significant results. The percentage of dry matter in the tops of mosaic bean plants, from the seedling to the blossoming stage, was, however, significantly lower than that in healthy plants, and the mosaic-diseased leaves transpired significantly less per unit of surface area and per gram of dry weight than the healthy.

Mosaic bean plants were found to produce a larger number of deformed flowers than the healthy, and their pods showed a tendency to be more curved and misshapen, and frequently were rough and oedematous. A water-soaked appearance of the pods was observed to be constantly associated with the mosaic under certain conditions; it was more severe on pods or plants that were infected just before or at the blossoming stage than on plants raised from infected seeds or infected in the seedling stage. On the average, the flowering of the latter plants was delayed by several days, while in plants infected during the flowering period, blossoming usually ceases for a period of several days, after which it is renewed. The ratio of the yield of pods to the dry weight is approximately the same in the mosaic and healthy plants, but the actual yield per plant is materially reduced on the mosaic plants, owing to the stunting effect of the virus.

The mosaic mottling was almost completely masked at both 15° and 30° C., and very distinct at both 20° and 25°. No rolling of the mosaic-infected leaves was observed at 15°, but increased in degree with a rise in temperature up to 30°, when the leaves of both mosaic and healthy bean plants were severely rolled up. The severity of mosaic symptoms was greater in strong light than in weak, but the length of daylight did not appear to exert any significant effect.

Harrison (A. L.). **Mosaic of the Refugee Bean.**—*Bull. N.Y. St. agric. Exp. Sta.* 656, 19 pp., 7 figs., 1935.

Investigations have shown that in the New York State bean mosaic [see preceding abstracts] constantly reduces by 10 to 20 per cent. the yield of the popular French bean [*Phaseolus vulgaris*] variety Stringless Green Pod Refugee, which is mainly used for preservation in tins. Among other injurious effects on the crop, the mosaic also causes a delay in the flowering and podding periods, this leading to the necessity of more pickings to get smaller yields; furthermore, the pods from mosaic plants are darker in the tins than normal, probably because of their water-soaked condition while still on the plants. The symptoms of the disease are described in some detail.

While a measure of control may be obtained by sowing mosaic-free beans and roguing the diseased plants as soon as they appear in the field, the results are too uncertain to warrant recommendation. Some progress has been already attained at the Geneva Agricultural Experiment Station in the development of commercially desirable varieties resistant to mosaic by crossing the Stringless Green Pod Refugee with the mosaic-immune Robust variety, and back-crossing the hybrids thus obtained with the former; it is now, probably, only a question of time until these varieties are ready for commercial production. The disease may, however, be minimized until then by certain cultural methods, such as growing the beans on exposed fields isolated from other leguminous crops.

Asuyama (H.), Nagai (Y.), & Nisikôri (T.). **A Helotium causing the black bulb disease of Allium bakeri Regel.**—*Ann. phytopath. Soc. Japan*, v, 3, pp. 216–224, 7 figs., 1935. [Japanese, with English summary.]

Field crops of *Allium bakeri* in Japan are subject to a black rot of the outer scales, which are reduced to a membranous consistency and permeated with a dense, dark-coloured mycelium giving rise, under moist conditions, to apothecia, with smooth stipes of variable length. The clavate asci measure 120 to 190 by 8 to 13 μ and contain eight uni- to bicellular spores, 13·3 to 19 by 5·7 to 6·7 μ. The fungus, which is believed to be a species of *Helotium*, grows well on agar media, producing on potato agar a white, floccose, aerial mycelium and a tough, blackish-brown thallus. After about four weeks black, stromatoid crusts are formed, from which arise the apothecia. A conidial stage was not observed. The optimum temperature for mycelial development is 20° to 25° C. The pathogenicity of the fungus was demonstrated by inoculation experiments.

[Labrousse (F.).] **La culture du Champignon de couche.** [Mushroom cultivation.]—52 pp., 6 pl., 19 figs., Bordeaux, Société Le Champion, 1935.

In this handbook directions are given for the commercial cultivation of mushrooms [*Psalliota campestris*], some of the chief points dealt with being the choice of a suitable place for the beds, the selection, preparation, and application of the manure, the method of gathering,

the maintenance of proper environmental conditions, and **mushroom**-growing in the open. A key is given for the identification of the pests and diseases attacking the crop based on the author's previous publication [*R.A.M.*, xiv, p. 213].

LEFEVRE (P.). **Quelques considérations sur la 'mosaïque du Manioc'.** [Some considerations on Cassava mosaic.]—*Bull. agric. Congo belge*, xxvi, 4, pp. 442–447, 3 figs., 1935.

Cassava mosaic [*R.A.M.*, xv, p. 203], first described in 1895 by Dammer from east Africa, is stated to be transmitted by diseased cuttings and by insects (*Bemisia gossypiperda* var. *mosaicivecta*) [ibid., xii, p. 137]. When the juice expressed from diseased plants was injected into the leaf parenchyma and sub-epidermal tissues of young shoots of healthy plants these all became diseased in a few days. Comparative manurial tests indicated that wood ashes had no effect on spread, while stable manure distinctly reduced it. Affected plants showed a definite reduction in yield. The bitter types of cassava appear to be more susceptible than the sweet ones, and exhibit symptoms of the disease as soon as the young leaves are formed. It is hoped to develop by selection strains which will remain unaffected under phytosanitary control.

FABRE (J. H.). **Sur les brûlures dues au soufre.** [On burns due to sulphur.]—*Progr. agric. vitic.*, civ, 52, pp. 615–616, 1935.

As applications of pure sulphur made to control vine *Oidium* [*Uncinula necator*: *R.A.M.*, xiv, pp. 75, 741] are liable in hot weather to cause scorching, many growers in north Africa give a first application of pure sublimed sulphur mixed by means of a shovel with an inert powder, usually sifted lime. As, however, the particles of the two constituents are seldom of the same fineness and density, and shovelling does not give a homogeneous mixture, the sulphur particles are badly spread on the vines, with the result that parts may be burned and others left unprotected. It is recommended that diluted sulphur prepared by the manufacturer should be used instead of the home-made product.

Reports on the work of Agricultural Research Institutes and on certain other agricultural investigations in the United Kingdom 1933–1934. —351 pp., H.M. Stationery Office, 1936.

This compilation, prepared on the same lines as that of the preceding year [*R.A.M.*, xiv, p. 422], comprises summaries of the work in progress at the various research stations, the laboratories of the Ministries of Agriculture for England and Northern Ireland, and the Department of Agriculture for Scotland, as well as the local investigations at advisory centres throughout the United Kingdom. Most of the phytopathological information presented in the report has already been noticed in this *Review* from other sources.

SMITH (F. E. V.). **Plant diseases. Report of the Government Microbiologist for 1934.**—*Rep. Dep. Agric. Jamaica, 1934*, pp. 23–24, 1935.

During the period under review the incidence of Panama disease of

bananas (*Fusarium oxysporum cubense*) [*R.A.M.*, xiv, p. 426; xv, pp. 105, 165] in parishes other than Portland amounted to 4,271 new cases and 149,907 recurrences (p. 22) as against 3,206 and 78,200, respectively, for 1933. At the time of writing the expedient of permitting one root treatment in St. Mary [ibid., xiv, p. 378] seemed to be fairly successful in maintaining a satisfactory level of production pending the development of an immune variety. It is stated on p. 2 of the report that the Cavendish banana [*Musa cavendishii*] was landed in England in a satisfactory condition in three small trial shipments in 1934. Promising results have been obtained on a small scale with the seedling S. 19, the fruit of which carries well.

A diminution in the intensity of the leaf disorder of coco-nuts previously reported from St. Mary [ibid., xiii, p. 79] was observed in consequence of better weather, but on the other hand bud rot [*Phytophthora palmivora*] [ibid., xv, p. 15] became abnormally prevalent. In the Montego Bay area a form of bud rot in which no fungal pathogen appears to be actively implicated has caused severe damage.

DEIGHTON (F. C.). **Mycological work.**—*Rep. Dep. Agric. S. Leone, 1934*, pp. 18–22, 1936.

In this report, the following items are of interest.

The continued severity of scab [*Sporotrichum citri*: *R.A.M.*, xiv, p. 428, and below, pp. 361, 362] on individual sour orange and rough lemon seedlings at Newton after long and careful treatment is attributed to individual susceptibility. Shading gave very beneficial effects in one test, only 11 per cent. of 463 sour orange seedlings under palm leaf shade developing scab, as compared with all of 401 seedlings in the open.

Early in July, 1934, psorosis [ibid., xiv, pp. 505, 627] appeared on late Valencia and Washington Navel oranges imported in 1925 from South Africa. The branch lesions were at first scraped, but fresh lesions broke out, and all the infected trees were burnt. On old, shrivelled grapefruits long kept in storage a dry rot of the bottom end was caused by an *Aspergillus* of the *A. wentii* [ibid., xii, p. 39] series. *Hypomyces ipomoeae* [ibid., xv, p. 100] was isolated from a grapefruit bruise rot and *Phytophthora parasitica* section *macrospora* Ashby from a rot of sweet lime.

Macrophomina phaseoli [ibid., xiv, p. 83] was occasionally present on the base of old stems of cowpea (*Vigna*) [*unguiculata*] and French beans [*Phaseolus vulgaris*]. Cowpea mosaic [ibid., ix, pp. 187, 666] was very common at Njala, this being the first certain record of the disease from Sierra Leone.

Rotting of the ripe fruit in bunches was common on oil palms [*Elaeis guineënsis*], especially on the Deli variety, at Njala in March and was present to a certain extent in April and May. *A Colletotrichum* [ibid., iii, p. 509; vii, p. 496] with cinnamon-brown spore masses was prevalent on the shrivelled fruit, *H. ipomoeae* and *Botryodiplodia theobromae* being occasionally present, apparently as secondary parasites. The disease occurs annually during the months mentioned.

The chief cause of rotting in ripe papaw fruits was *Glomerella cingulata*; other fungi which sometimes appeared to cause fruit rot of this host (*G. cingulata* always being present on another part of the same

fruit) were *C. capsici* [ibid., xiv, pp. 15, 344], *B. theobromae*, *Helminthosporium gigasporum* [ibid., i, p. 162], and a *Fusarium*; a species of *Phoma* was associated with stylar end rot.

Other records include *Cercospora canescens* [ibid., xiv, p. 87; xv, p. 60] on *Crotalaria juncea* and tomato, *C. canavaliae* on *Canavalia ensiformis*, *C. ipomoeae* on *Ipomoea purpurea*, *H. turcicum* [ibid., xv, p. 289] on *Sorghum margaritiferum*, *Ragnhildiana manihotis* on cassava [ibid., xiv, p. 396; xv, p. 59], and *Tryblidiella rufula* [ibid., xii, p. 791] var. *microspora* on dead twigs of lime.

Forty-fifth Annual Report for the fiscal year ended June 30, 1935.—*Bull. Wash. St. agric. Exp. Sta.* 325, 83 pp., 1935.

In the section of this report dealing with agronomy (pp. 13–22) it is stated by E. F. Gaines and A. M. Schlehuber that of 281 White Odessa × Turkey-Florence F_4 progeny tested for resistance to physiologic form Ft-4 of wheat bunt [*Tilletia caries*] the progeny from resistant F_3 rows in general produced resistant F_4 rows [*R.A.M.*, xiv, p. 286; xv, p. 287]. The F_4 rows showed from 0·2 to 91 per cent. infection in 1935, and an average for all rows of 6·7 per cent. less bunt in 1935 than in the F_3 rows from which they were selected in 1934.

Tests of 312 F_4 and F_5 selections from 10 crosses inoculated with a mixture of 20 bunt biotypes gave 0 to 91 per cent. infection, the average of each cross varying from 0·3 to 9·8 per cent. bunt, while 139 rows were bunt-free. This group offers promising material from which to select super-resistant strains for commercial use. Twenty-seven F_5 selections of Oro × Hybrid 128 and six F_5 selections of White Odessa × Ridit were of sufficient promise to be advanced to the yield tests in 1936. Several selections of Oro × Hybrid 128 were consistently more resistant than the Oro parent in the F_3, F_4, and F_5 generations.

Reciprocal crosses of Baart-Ridit × Federation were tested in the F_3 generation for resistance to three bunt forms, viz. T–1, *T. levis* [*T. foetens*] from Ridit wheat and *T. tritici* [*T. caries*] from Ridit. Baart-Ridit is resistant and Federation susceptible to T–1 and the Ridit form of *T. foetens*; both are resistant to the Ridit form of *T. caries*, as were also all of the 90 F_3 families. Both T–1 and the Ridit form of *T. foetens* produced transgressive segregation, indicating more than one factor for resistance. The most striking example of inherited resistance to the standard mixture of 20 bunt forms was found in 48 spring segregates from a cross between Federation and Ridit; all were highly resistant, 34 being bunt-free, and 14 producing from a trace to 1 per cent. infection.

In the section dealing with plant pathology (pp. 50–53) it is stated that in seed disinfection tests against wheat bunt, carried out by F. D. Heald, C. S. Holton, and E. F. Gaines, basic copper sulphate reduced infection to a negligible amount (0 to 0·1 per cent.) and caused improved germination after the seed had been stored for one year; copper arsenite was no better than copper carbonate in reducing infection due to soil contamination. Washing reduced seed-borne infection in one instance from 25·6 to 3·1 per cent.

In a study on bitter pit, F. D. Heald and R. Wellman found that apple trees known to produce affected fruit [ibid., xv, pp. 300–2] in

some cases showed a very evident mosaic mottle on the leaves very early in the season, while in others the mosaic symptoms were very faint [ibid., xiv, p. 639]. Field studies in spring and early summer demonstrated that a faint mosaic mottle of various apple varieties is common throughout the Wenatchee district. Cherry trees in the irrigated valleys of central Washington also showed a mosaic mottle [ibid., xiv, p. 368].

In western Washington, L. K. Jones and F. Johnson found that considerable damage was caused to peas, especially market-garden varieties, by mosaic [ibid., xv, pp. 28, 274] and streak [ibid., xi, p. 218]. Preliminary tests indicated that the viruses concerned are seldom seed-borne. A study of the symptoms set up and the virulence, host range, percentage transfer, longevity, and thermal death point of the viruses showed that two distinct mosaic diseases were commonly present on peas.

Eritrea: plant diseases and pests observed since 1930.—*Int. Bull. Pl. Prot.*, x, 1, pp. 2–4, 1936.

A list, compiled at the Agricultural Bureau of Eritrea, is given of the fungi, bacteria, virus, and physiological diseases, and insect pests observed since 1930 affecting cultivated and wild plants in the Colony.

Van der Goot (P.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1934.** [Diseases and pests of cultivated crops in the Dutch East Indies in 1934.]—*Meded. Inst. PlZiekt., Buitenz.*, 85, vii+94 pp., 1935.

Among the many references of interest in this report, prepared on the usual lines [*R.A.M.*, xiv, p. 742], the following may be mentioned. Mouldy rot [*Ceratostomella fimbriata*] of *Hevea* rubber was prevalent and severe in West Java, where stripe canker [*Phytophthora palmivora*] and brown bast [ibid., xii, p. 80] were also reported, the latter occurring chiefly on less favourably situated estates where an unduly frequent tapping system was practised. In elevated positions mildew [*Oidium heveae*] was prevalent and more active steps were taken for its control by sulphur dusting than in 1933. This disease was also reported from Central Java, Malang, and the General Experiment Station of the A.V.R.O.S. In two young plantations on the north coast of Central Java the brown root fungus (*Fomes noxius*) [ibid., xv, p. 136) was observed. *Ganoderma pseudoferreum* assumed a serious form in a plantation under the supervision of the General Experiment Station, causing decortication of the tap- and side-roots, collar, and stem.

Coffee in Central Java was extensively attacked by *Corticium salmonicolor*, and a *Rhizoctonia* was responsible for damping-off in the seed-beds. Top die-back (*R.* sp.) [ibid., xv, p. 17] has now been found in most plantations in Malang and Kediri, seven new centres of infection having been observed in 1934. Efforts have been made to combat the disease by the excision of infected material in an incipient stage. From two estates at a high altitude in the Besoeki district symptoms resembling those caused by *C. koleroga* [ibid., xv, p. 3] were reported, but fructifications of the causal organism were not obtained.

Reports from the Java Sugar Industry Experiment Station at Pasoeroean state that sugar-cane mosaic is extremely prevalent, and

that in some plantations the widespread infection, not only of maize [see below, p. 386] but also of grasses in the vicinity, precludes the eradication of the disease from the setts. Yellow spot (*Cercospora kopkei*) [ibid., xiv, p. 153] was favoured by the damp, sunless period from December, 1933, to May, 1934, and assumed a much more serious form than in the preceding year. The same conditions were conducive to the development of pokkah-boeng (*F.* sp.) [*Gibberella moniliformis*: ibid., xiv, p. 743], especially in West Java. Gumming disease [*Bacterium vasculorum*: ibid., xv, p. 317] was prevalent among both setts and field canes in West Java.

Bact. [*Bacillus*] *aroideae* occurred both in the field (top rot) and in the curing-barn (hollow stalk) on a Deli (Sumatra) tobacco plantation [ibid., xiii, p. 274], involving a loss of 2,000,000 leaves. *Pythium* stem scorch was present throughout Deli, causing a maximum of 80 per cent. infection.

Okabe (N.). **Bacterial diseases of plants occurring in Taiwan (Formosa). VI.**—*J. Soc. trop. Agric. Taiwan*, vii, pp. 219–227, 1 fig., 1935.

In this paper [cf. *R.A.M.*, xiv, p. 738] full details are given of the symptoms and the morphological, cultural, and physiological characters of *Bacterium andropogoni* [ibid., ix, p. 774], the agent of a leaf and sheath disease of sorghum and broomcorn [*Sorghum bicolor* var. *technicus*], and of *Bacillus carotovorus* type B [ibid., x, p. 736; xi, p. 700] causing a soft rot of Welsh onions (*Allium fistulosum*) and leeks (*A. porrum*) in Formosa, Japan. Inoculations with the latter organism were successful on *A. cepa* (leaves and bulbs), potato, tobacco, tomato, and cabbage (seedlings), as well as on the hosts mentioned.

Koehler (B.). **Seed treatments for the control of certain diseases of Wheat, Oats, Barley.**—*Bull. Ill. agric. Exp. Sta.* 420, pp. 499–575, 17 figs., 1935.

The author describes a comprehensive series of seed disinfection experiments carried out against some of the major diseases of wheat, oats, and barley in Illinois during a period of 12 years with new organic mercury disinfectants and older materials, preceding his remarks with a brief historical résumé of cereal seed disinfection and a short account of the symptoms and control of the diseases concerned.

The results obtained [which are tabulated and fully discussed] showed that wheat bunt (*Tilletia levis*) [*T. foetens*] was controlled and good increases in yield obtained when the seed was treated with 18 to 20 per cent. copper carbonate, ceresan, and new ceresan at the rate of 2 or 3 oz., 2 oz., and ½ oz. per bush., respectively. The best results against wheat scab (*Gibberella saubinetii*) were given by the two last-named products, though with nearly disease-free wheat seed copper carbonate gave the best increase in yield. All three materials increased the winter survival of winter wheat. The benefits from treating non-infected wheat seed were not always commensurate with the trouble and expense involved, and where wheat is not a major crop but is grown in rotation, the seed should be treated only when bunt or scab occurs; where, however, wheat is grown more extensively, the seed should be disinfected annually.

The oat smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*]) were well controlled by formaldehyde, applied as a spray (1 part formalin to 1, 2, or 3 parts water, 1 qt. solution to 50 bush., applied by a hand spray to each shovelful as it is picked up), sprinkle (1 pt. to 80 bush.), or dust, ceresan, and new ceresan, the increased yields given by the last-named as compared with formaldehyde more than compensating for the extra cost. Formaldehyde spray or sprinkle was the cheapest treatment, and is recommended as a second choice after new ceresan. The formaldehyde dust deteriorated rapidly in storage. Ceresan and new ceresan significantly increased yields when smut-free oat seed was used.

Ceresan and new ceresan were outstanding in controlling barley smut (*U. nigra* [*R.A.M.*, xv, p. 211] and *U. hordei*), stripe (*Helminthosporium gramineum*), and scab (*G. saubinetii*), and in increasing yields, but as *U. nuda* is controllable only by the hot-water treatment an objectionable amount of smut may persist after treatment with new ceresan. The Wisconsin Pedigree 38 barley variety being highly resistant to stripe [ibid., xiii, p. 155], and not having shown much smut infection in Illinois, seed treatment is recommended for this variety only when the seed is scabby or smut infection becomes important.

No damage resulted when copper carbonate-treated oat seed was stored for one year, but when seed treated with formaldehyde dust, ceresan, or new ceresan was stored even for a week some depression in yields resulted, longer storage conducing to still greater injury. If, however, the approximate storage period is known it is believed that a dosage can be determined that will give as good results as treatment immediately before sowing.

As wheat bunt balls in the seed cause some infection in spite of treatment they should be removed by proper cleaning machinery [ibid., xv, p. 286].

Imai (S.). **On the causal fungus of the Typhula blight of gramineous plants.**—*Jap. J. Bot.*, viii, 1, pp. 5–18, 4 figs., 1936.

In the spring of 1926 the globose, oblong, or irregular, reddish-brown sclerotia, 0·5 to 4·5 mm. in diameter, of the species of *Typhula* responsible for the snow blight of wheat, barley, oats, and other Gramineae in Japan [*R.A.M.*, xiv, p. 568] were sown on moist sand in a pot, and in the following autumn rose-coloured fruit bodies, 3·5 to 30 mm. in height, were formed, the clubs of which measured (average of 50) 0·9 to 3·5 by 0·2 to 1 mm., the stipes 1 to 4 by 0·2 to 0·6 mm., and the spores 7·5 to 12·2 by 3·8 to 5·6 μ. Two years later similar fructifications were collected in a field in Hokkaido where a cereal crop had been badly damaged by the blight in the previous season. In 1929 fructifications identical with the foregoing were produced by sclerotia from several localities in northern Honshu. In 1932 a comparative cultural study was made, on a number of standard media, of the Japanese *Typhula* and material of *T. graminum* from Holland, the clubs, stipes, and spores of which measured, respectively, 0·8 to 4·5 by 0·3 to 1 mm., 1 to 2·5 by 0·2 to 0·5 mm., and 9·3 to 13·1 by 4 to 6 μ; these dimensions are in close agreement with those of the Japanese fungus, and in fact the sole difference between the two was the colour of the mycelium on malt extract agar, the Japanese (under surface) ranging from pale

ochraceous-salmon to salmon-buff and the Dutch from orange-cinnamon to light vinaceous-cinnamon.

The characters of the Japanese fungus under observation are very similar to those of *T. elegantula* Karst. with which the author formerly considered it identical [ibid., ix, p. 29]. It differs, however, from this species in the presence of sclerotia. The customary identification of the fungus with *T. graminum* Karst. [loc. cit.] cannot, in the writer's opinion, be maintained owing to important differences in the fructifications, and the author considers that the name *T. itoana* which he proposed for it in 1929 should be adopted. The Dutch strain is regarded as identical with it. The sterile fungus referred by Eriksson in 1879 to *T. graminum* on account of the resemblance of its sclerotia to those of the supposed hibernating form, *Sclerotium fulvum* [*R.A.M.*, viii, p. 439; xiii, p. 434], is thought to be also probably identical with *T. itoana*. The same may also well apply to the fungus investigated by Hungerford and Remsberg in the United States [ibid., xii, p. 367].

Waldron (L. R.) & Clark (J. A.). **Breeding rust-resistant spring Wheats.**—*Science*, N.S., lxxxiii, 2144, pp. 106–108, 1936.

The disastrous epidemic of stem [black] rust of wheat [*Puccinia graminis*] in North Dakota and neighbouring States in 1935 (the worst since 1916) has again emphasized the major importance of breeding for resistance as a means of combating the disease. During the past year promising results were given by certain hybrids between the resistant Hope variety [*R.A.M.*, xv, p. 284] or H-44 (an allied strain) and various susceptible but commercially more successful wheats. At Langdon, for instance, where the incidence of infection approached 100 per cent. and Ceres and Marquis yielded, respectively, only 3·3 and 0·4 bush. per acre, Hope itself produced 15·5 bush. and various hybrids with Hope as one parent gave up to 18·7 and showed little trace of the disease. In some of the crosses, e.g., Hope × Ceres, resistance to rust was accompanied by other desirable characters. From another cross combining the Australian variety Florence with Hope and Ceres a yield of 23·3 bush. per acre was obtained.

Besides Hope and Marquillo, only one named rust-resistant variety (Thatcher) had been distributed before 1935, but the encouraging outcome of the hybrid tests during that critical season is thought to afford a sound basis for future breeding work, more especially as the virtual immunity of the emmer progenitor gives every indication of permanence.

Bryzgalova (Mme V. A.). Бурая ржавчина Пшеницы в условиях Иркутско-Нижне-Удинской зоны Восточносибирского края. [Brown rust of Wheat under the conditions prevalent in the Irkutsk-Nijne-Udinsk region of East Siberia.]—*Тр. Защ. Раст. вост. Сибири* [*Bull. Pl. Prot. E. Siberia*], 2(4), pp. 99–174, 6 graphs, 1935.

This is a tabulated, summarized account of the author's studies and observations on brown wheat rust (*Puccinia triticina*) [*R.A.M.*, xiv, p. 292; xv, pp. 83, 201] since 1926 in the region of East Siberia extending from Irkutsk to Nijne-Udinsk, where it is stated to be the only cereal rust of economic importance. It was found that in the western

part of this region the rust is capable of overwintering in the uredo stage on volunteer wheat plants, and that, in general, infection of cultivated wheat starts in the spring about the second half of June, evidently from such volunteers since no importation of the rust from outside was observed, and the first infection of *Thalictrum* spp. is usually seen some five to ten days after the first appearance of uredosori on the wheat. In the forest-steppe zone teleutospores do not mature every year, owing to low rainfall in the autumn and drought conditions in early spring.

The intensity of spring infection of wheat with brown rust in East Siberia is chiefly determined by the overwintering of the uredospores, the date of primary infection of the wheat, the occurrence of adequate and frequent rain and of minimum night temperatures not below 8° C. in June, and a more or less regular alternation of rainy and sunny, warm days in July. Early and severe infection, reaching its maximum at the flowering stage, results in a loss of crop ranging from 65 to 75 per cent.; later infection, reaching its maximum at the milky maturity stage of the grain, gives from 54 to 63 per cent. loss; while moderate infection reaching its maximum at the waxy maturity stage, only causes 28 to 31 per cent. loss; light infection, on the other hand, with the maximum attack at the time of the milky maturity stage, generally gives only 6 to 10 per cent. reduction in yield.

The results of the investigations indicated that locally the rust may be best controlled by very early sowing of the wheat, since such crops suffered considerably less damage from the rust than later ones; by careful and early harvesting and removal of the wheat, to avoid shedding of the grain from the ears; and by early and thorough ploughing up of wheat stubble, to prevent the growth of volunteer wheat plants.

Bryzgalova (Mme V. A.). Оценка сравнительной устойчивости сортов яровой Пшеницы к мокрой-головне и бурой ржавчине для Прибайкальской части Восточносибирского края. [Evaluation of the relative resistance of spring Wheat varieties to bunt and brown rust in the Lake Baikal region of East Siberia.]—*Тр. Защ. Раст. вост. Сибири* [*Bull. Pl. Prot. E. Siberia*], 2(4), pp. 175–203, 1935.

The author states that owing to the peculiar climatic conditions in East Siberia, especially the long, dry, and cold springs, spring wheats are very liable to be attacked by bunt [*Tilletia caries* and *T. foetens*: *R.A.M.*, xiv, pp. 22, 225], fields with 80 to 90 per cent. infection being in no way exceptional some years ago, while even at present crops showing as much as 50 to 60 per cent. infection are quite frequent in the less progressive collective farms. For the same reasons seed-grain disinfection is not always effective in protecting the wheat crop from bunt, and the development of bunt-resistant wheat varieties is therefore all the more imperative. Observations since 1931 and careful varietal resistance tests in 1933 and 1934 [the results of which are tabulated] showed that all the local varieties are more or less susceptible, and that even such varieties as Hordeiforme 010, Lutescens 062, and Milturum 0321, which exhibit high resistance in the rest of the U.S.S.R., are considerably more susceptible in East Siberia. The first-named variety was the only one to show relative resistance to bunt in the tests.

Similar varietal tests in the same years for resistance to brown wheat rust (*Puccinia triticina*) [see preceding abstract], the results of which are also tabulated, equally showed the absence of local varieties highly resistant to the rust; moderate resistance under the local conditions, combined with acceptable commercial qualities, was only exhibited by the imported varieties Garnet, Kamalinsky 2559, and Kitchener, all of which are very susceptible to bunt. Conversely, the moderately bunt-resistant Lutescens 062 is highly susceptible to brown rust.

GIGANTE (R.). **Ricerche sopra l'influenza del boro sulla resistenza delle piante agli attacchi parassitari.** [Researches on the influence of boron on plant resistance to parasitic attacks.]—*Boll. Staz. Pat. veg. Roma*, N.S., xv, 3, pp. 471–483, 1 fig., 1935. [English summary.]

When wheat of the highly susceptible Michigan Bronze variety was grown in the greenhouse in pots containing soil to which sodium borate was added at the rate of 1, 2, 4, 8, and 16 gm. per sq. m. of soil surface [cf. above, p. 338] and the plants were artificially inoculated with the uredospores of *Puccinia triticina*, the resultant infection was very severe (type 4) in the control pots and those containing 4 gm. or less of sodium borate per sq. m., while it was less so in the pots containing sodium borate at the rate of 8 (between type 3 and type 2) and 16 gm. (type 3) per sq. m. In field plot tests with Mentana wheat soil applications of sodium borate at the rate of 0·5, 1, 2, and 5 gm. per sq. m. of soil surface reduced infection by *P. glumarum*, and markedly stimulated growth.

SIBILIA (C.). **Relazione sulle esperienze di lotta diretta contro le ruggini del Grano nell' anno 1935.** [An account of experiments on the direct control of Wheat rusts in the year 1935.]—*Boll. Staz. Pat. veg. Roma*, N.S., xv, 3, pp. 484–489, 1935.

In a further test carried out near Alessandria, northern Italy, in 1935, during weather strongly favourable to infection, a field of Damiano Chiesa wheat was dusted with natural sulphur at the rate of 40 kg. per hect. on 25th May (after four days' rain), 4th June (after four days of rain and wind), and 10th and 17th June. Rust (*Puccinia triticina* and *P. glumarum*) [*R.A.M.*, xiv, p. 293] infection was exceedingly slight, but the beneficial effect of the dusting was shown in the increased yield of the treated wheat over the untreated, the figures being 47·17 and 46·33 quintals per hect., respectively, yielding a profit of L. 0·60 per hect. This result is considered to indicate that dusting with natural sulphur is not uneconomical even in seasons when rust infection is practically negligible.

JOHNSON (T.) & JOHNSON (O.). **Studies on the nature of disease resistance in cereals. III. The organic nitrogen content of mature and immature tissues of the Wheat plant in relation to stem-rust resistance.**—*Canad. J. Res.*, xiii, 6, pp. 355–357, 1935.

The results of the studies reported in this paper [cf. *R.A.M.*, xiv, p. 226] showed that in six wheat varieties examined about one week before the emergence of the flag leaf the organic nitrogen content of the immature tissues (i.e., the leaves folded within the uppermost sheaths)

was less than that of the mature tissues (i.e., the fully-grown leaves of the upper halves of the plants). The greater susceptibility of the younger tissues to stem [black] rust [*Puccinia graminis*] as compared with the mature ones cannot, therefore, be attributed to a higher nitrogen content of the former [cf. ibid., xiv, p. 88].

COSTANTIN (J.). **Actualités biologiques. Le problème des rouilles du Blé à l'heure présente.** [Biological notes. The problem of Wheat rusts to-day.]—*Ann. Sci. nat., Bot.*, Sér. X, xvii, 2, pp. i–xviii, 1935.

After pointing out that in attempts to breed a type of wheat resistant to rusts (*Puccinia* spp.) workers have failed to take into consideration the known effects of high altitudes and high latitudes in increasing the vigour of the plants, and have neglected to introduce 'mountain blood' into the hybrids, the author refers to the relationship in Kenya between altitude and the resistance of Equator wheat to rust [*R.A.M.*, xiii, p. 222] and of coffee to *Hemileia vastatrix* [ibid., i, p. 51], and suggests that it may be possible to develop a type of wheat resistant to rust in mountain areas in Europe. In a preliminary test at Versailles Equator wheat showed some resistance to *P. glumarum*.

OLGYAY (M. v.). **Beizungsuntersuchungen mit Wasserstoffsuperoxyd im Laboratorium.** [Disinfection experiments with hydrogen peroxide in the laboratory.]—*Z. PflKrankh.*, xlvi, 1, pp. 1–6, 1936.

As already shown by Pichler and confirmed in the writer's laboratory tests at Budapest, hydrogen peroxide at the rate of 3 l. per 100 kg. of seed-grain is ineffectual against wheat bunt [*Tilletia caries* and *T. foetens*] at all concentrations [*R.A.M.*, xiv, p. 619]. Used at the rate of 4 l. per 100 kg. in a 20 per cent. concentration the preparation inhibited the germination of the fungi but simultaneously reduced that of the wheat. A further disadvantage of hydrogen peroxide is its costliness.

BRIGGS (F. N.). **Inheritance of resistance to bunt, Tilletia tritici, in hybrids of Turkey Wheats C.I. 1558 B and C.I. 2578.**—*Hilgardia*, x, 1, pp. 19–25, 1 graph, 1935.

In these studies on the inheritance of resistance to *Tilletia tritici* [*T. caries*] in wheat (physiological form VIII of Bressman being used as inoculum) [*R.A.M.*, xi, p. 33, and above, p. 344], hybrids of Turkey 1558 B with Baart gave progeny approximately in the ratio 1 resistant, 2 segregating, and 1 susceptible, both F_2 and F_3 data indicating that resistance is incompletely dominant. Crossing with Turkey 3055 showed that the major factor for resistance is the Turkey factor [ibid., xiii, p. 361]. Hybrids of Turkey 2578 with Baart approximated closely to the 1 : 2 : 1 ratio, and further evidence that the resistance of the former results from a single factor was furnished by crossing it with Martin, when the progeny segregated in close agreement with the 15 : 1 ratio, this segregation being similar to that of Martin × Turkey 1558 B. These data indicate that resistance is incompletely dominant and the factor for resistance was found to be the Turkey factor also. This makes a total of five wheat varieties, all of the Turkey type, depending for resistance on the Turkey factor. One variety of the Turkey type, Sherman, has already been found to have the Martin factor [loc. cit.]

for resistance, and the fact that two of the three major factors for resistance are thus present in Turkey wheats should facilitate their combination in a single variety of the Turkey type.

KOSTOFF (D.). **Inheritance of natural immunity in plants with special reference to production of immune varieties by interspecific hybridization.**—*Ann. Acad. tchécosl. Agric.*, x, 4, pp. 389–402, 7 figs., 1935. [Czecho-Slovakian summary.]

Following a concise discussion of the cytogenetical principles underlying plant breeding work for transmission to susceptible species or varieties of the natural disease resistance of other varieties by intra- and interspecific and intergeneric hybridization [*R.A.M.*, xiv, p. 116 *et passim*], with particular reference to wheat, the author states that his investigations of the problem in crosses of the highly disease-resistant *Triticum timopheevi* [ibid., xiv, p. 225] (28 chromosomes) showed that this wheat may be crossed with some difficulty with all the other *Triticum* species, as well as with rye and *Haynaldia* [*Agropyron*] *villosum*; it was further found that one of the *T. timopheevi* genoms (7 chromosomes) conjugates with the A genom of the other wheat species, while the other genom conjugates only partially with the B genom of the latter. If the immunity of *T. timopheevi* is localized in the conjugating chromosomes, it may be possible to transfer its immunity to the other species of *Triticum*, after the usual self-sterility of the hybrids (single grains are rarely set) is overcome by back-crossing. The chromosomes of rye do not usually conjugate with those of *Triticum* species, this rendering very problematical the possibility of transferring its disease resistance to wheat.

The breeding of the sugar-cane P.O.J. 2878 is cited as an instance of the successful application of cytogenetic methods, and the author is of opinion that the production of immune varieties is most surely and rapidly effected by hybridization in conjunction with genetic and cytogenetic investigations of the material.

STEINER (H.). **Die Halmbruch- oder Lagerfusskrankheit des Getreides.** [The strawbreaking or lodging foot rot of cereals.]—Reprinted from *Landeskultur*, [ii], 8, 4 pp., 2 figs., 1935.

A semi-popular description is given of the foot rot of cereals caused by *Cercosporella herpotrichoides* [*R.A.M.*, xv, p. 288], the presence of which was established for the first time in Austria in 1935 on wheat samples from Burgenland and Lower Austria.

STRAIB (W.). **Untersuchungen über erbliche Blattnekrosen des Weizens.** [Investigations on hereditary foliar necroses of Wheat.]—*Phytopath. Z.*, viii, 6, pp. 541–587, 10 figs., 1935.

A comprehensive, tabulated account is given of the writer's studies at the Brunswick Botanical Institute on certain hereditary necrotic disorders affecting wheat (*Triticum vulgare* of the Heines Kolben and related types, *T. compactum*, *T. durum*, and *T. polonicum*) leaves and assuming in the two first-named the form of an extensive brownish-yellow discoloration produced by the gradual coalescence of a number of originally isolated lesions, and in the others a more restricted bluish-

p. 223] germinated readily in nutrient solutions (especially 1 per cent. glucose), but in water alone there was a delay of 45 days before germination took place in 1934, though a year later it began both in distilled and in spring water after 24 hours. Rapid germination with the production of sporidia took place in soil extracts. In acetic acid germination occurred only at concentrations below 1 per cent. The addition of 0·005 per cent. calcium cyanamide or 0·01 per cent. kainit to 1 per cent. glucose reduced the germination within 48 hours from 90 to 40 and from 90 to 70 per cent., respectively. Great resistance was shown to the action of ultra-violet rays, though when the exposure was made after germination had started the probasidium and sporidia produced were shorter and thicker than normal.

When chlamydospores of *U. zeae* were strewn on the surface of soil in pots and also buried at various depths, some of the pots being watered and the remainder kept dry, it was found that the buried spores showed a lower germination rate than those on the surface. Watering greatly reduced the vitality of the buried spores, the reduction being progressive from February to June, but stimulated the vitality of the surface-strewn spores. The humidity factor is probably of much practical importance, and the most favourable conditions for infection appear to be set up when a wet period occurs and the plants are in a susceptible stage of growth following a dry spell from February to May.

Heavy soil dressings with calcium cyanamide and kainit had practically no effect on infection. The severe outbreaks of *U. zeae* that occur on plots dressed with fresh stable manure are due, in the author's opinion, to the increased susceptibility of the treated plants and not to any stimulatory effect on the fungus.

That infections by *U. zeae* are entirely local and are due to air-borne spores and sporidia was demonstrated by the fact that when sporidia were artificially prevented from reaching the aerial parts of plants growing in inoculated soil no infection took place.

EDWARDS (E. T.). **Studies on Gibberella fujikuroi var. subglutinans the hitherto undescribed ascigerous stage of Fusarium moniliforme var. subglutinans and on its pathogenicity on Maize in New South Wales.** —*Sci. Bull. Dep. Agric. N. S. W.* 49, 68 pp., 25 figs., 1935.

This is an expanded version of the writer's studies on *Gibberella fujikuroi* var. *subglutinans* on maize in New South Wales, a preliminary note on which has already appeared [*R.A.M.*, xiii, p. 299].

The existence within the fungus of two biological strains has been demonstrated on material collected at Bathurst and Grafton, respectively. The mycelia of both grew most rapidly at 30° C., near which the optimum temperature probably lies. Striking cultural differences [which are summarized in tabular form] were observed on potato dextrose agar between the two strains at various temperatures from 5° to 40°, especially in the lower ranges. The viability of the mycelium in steamed maize grain cultures was found to persist for a period of $2\frac{3}{4}$ years at room temperature, while ascospores from material up to 18 months old germinated readily. A full morphological description and revised diagnosis of the fungus are given.

During the season of 1934–5 serious losses occurred in some districts

through defective germination and seedling blight due to the use of seed-grain internally infected by *G. fujikuroi* var. *subglutinans*. The examination of samples of seed-grain from the principal maize-growing areas of the Colony revealed a high percentage of internal seed-borne infection by this fungus (average 7·9), the corresponding figures for *G. moniliformis* [ibid., xv, p. 289], *Penicillium* spp., and *Cephalosporium acremonium* being 8·9, 6·8, and 5·3, respectively. Extensive seed-borne infection was shown by inoculation experiments to follow the application to the silks of the ears at the late milk to early dough stage of a spore suspension and the insertion into the shank attachment or basal ear tissues of fragments of agar cultures of *G. fujikuroi* var. *subglutinans*.

Comparative soil inoculation experiments with *G. fujikuroi* var. *subglutinans*, *G. moniliformis*, and *G. saubinetii* showed that each of these fungi is responsible for considerable reductions in the stand and consequent grain yield of maize under normal field conditions in New South Wales. Thus, at the New England Experiment Farm, Glen Innes, the percentages of seedlings surviving to maturity after inoculation through the soil by these three organisms were 66·4, 69·8, and 62·8, respectively, as against 100 in the uninoculated control plot, the corresponding mean yields per plot, 8 yds. long by 14 yds. wide, being 34·3, 32·3, and 39·5 oz., respectively, compared with 56·5 oz.

Some experimental evidence was obtained in the laboratory for the production of *G. fujikuroi* var. *subglutinans* of a stimulatory substance inducing premature germination of the grain, but under field conditions the parasite appears rather to exercise a depressing effect on seedling growth.

Buchheim (A.). **Einfluss von Brandbefall auf Wachstum und Habitusbild der Wirtspflanze.** [The influence of smut infection on growth and habit of the host.]—*Phytopath. Z.*, viii, 6, pp. 615–621, 3 figs., 1935.

Measurements of the length of healthy millet [*Panicum miliaceum* var. *subaureum*] plants and of those attacked by smut [*Ustilago panicimiliacei*] at the Moscow Agricultural Academy [*R.A.M.*, x, p. 181] showed the latter to be apparently longer (78·73±18·9 cm.) than the former (76·96±12·1 cm.), the corresponding figures for the stems being 57·3±1·0 and 36·6±0·692 cm., respectively. Thus the fungus exercises a stimulatory action on the growth of the leafy stem while suppressing that of the floral panicles, a difference presumably due to the intensive development of the mycelium in the former and to the relative inactivity of the reproductive organs in the latter. Similar relationships were observed in maize and sorghum attacked by *Sorosporium reilianum* [ibid., xiv, p. 504], while the growth of wheat ears infected by loose smut [*U. tritici*] was curtailed (average length of 115 diseased ears 30·13±4·3 cm. compared with 47·21±10·3 cm. for 122 healthy ones).

Ruggieri (G.). **Sopra i presunti rapporti genetici col Limone e col Cedro di una particolare varietà di Limone assai resistente alla 'Deuterophoma tracheiphila' Petri.** [On the presumed genetic relation with Lemon and Lime of a particular Lemon variety highly resistant to *Deuterophoma tracheiphila* Petri.]—*Boll. Staz. Pat. veg. Roma*, N.S., xv, 3, pp. 496–499, 1935.

The Interdonato lemon, which is very resistant to *Deuterophoma*

the manganese content remains the same as before sterilization. Reduction of insoluble manganic-complexes to soluble manganous compounds, as suggested by Steenbjerg [*R.A.M.*, xv, p. 87], is excluded because there was no increase either of water-soluble or exchangeable manganese. Lundegårdh has shown [ibid., xii, p. 19] that the manganese content of diseased plants [in Sweden] may be even higher than that of healthy ones, thereby furnishing further evidence of the implication of some other agency in the etiology of the disorder. The reinfection of formalin-sterilized soil with 1 or 5 per cent. of the original soil led to the reappearance of the grey speck symptoms in their former intensity. Quartz sand cultures low in manganese remained healthy under sterile conditions, but developed the disease after infection with a few grams of unsterilized soil. Similarly, in sterile water cultures with little manganese, the plants were quite healthy, though somewhat stunted, whereas on infection with a diseased root tip or a mixture of bacteria isolated from diseased roots, they contracted the disturbance in a typical and virulent form. The addition to the culture solution of 0·001 to 0·002 per cent. germisan kept non-sterile plants with a low manganese content healthy, whereas the non-disinfected controls were severely attacked. On the basis of these facts, it is necessary to differentiate between the purely physiological effect of manganese deficiency (growth retardation) and the much more complex symptoms of grey speck, induced by a combination of factors.

Diseased roots of oats in the field, or in sand or water cultures, invariably show signs of microbiological disintegration. The alkaline products produced by moulds or bacteria in the root tips appear to be transported by the sap stream to the leaves, where they give rise to typical spots. When a leaf showing the first symptoms of grey speck was cut off and placed in a 0·1 per cent. solution of phenol red, it rapidly developed small, red spots corresponding to P_H 8·2. The presence of ammonia in abnormally large quantities was frequently detected in diseased plants, and the excess of this element probably retards the appearance of the symptoms during the winter when the bacteria liable to invade the roots are inactive. In the spring, after a few warm days, the disease breaks out vigorously.

No satisfactory explanation has hitherto been found for the occurrence of grey speck on mixtures of normal sand and clay. Pot experiments showed a much reduced and partially decayed root system in quartz sand mixtures with 10 and 25 per cent. clay. It may reasonably be inferred that this phenomenon is due, not only to the diffusion of alkaline substances from the clay into the adjacent sandy soil, causing the precipitation of soluble manganous compounds, but also to the development, under the influence of the favourable soil reaction in the diffusion zone, of certain manganese dioxide-precipitating bacteria and moulds.

Regarding the function of manganese the writer's experiments indicate that it intensifies photosynthesis by accelerating the oxidation processes connected with the photochemical reactions in the leaf. Shortage of manganese retards carbon assimilation and so leads to a carbohydrate deficit throughout the plant; consequently the roots remain small and cell division in their tips is so slow that they finally succumb to infection by micro-organisms. The leaf structure is weakened,

and the delay in the formation of organic acids, which would normally neutralize the minute quantities of alkaline substances produced by the root bacteria, probably accentuates the typical foliar spotting.

GORLENKO (M. V.). Причины массового поражения Овса корончатой ржавчиной (**Puccinia coronifera Kleb.**) в **1933** году в Воронежской области. [The causes of the epidemic outbreak of crown rust (*Puccinia coronifera* Kleb.) on Oats in 1933 in the Voronezh region.]—*J. bot. U.R.S.S.*, xx, 5, pp. 475–486, 1 graph, 1935. [English summary.]

The field observations reported in this paper were made in the Voronezh region [south Russia] during the years 1931 to 1934, the first two of which were marked by epidemic outbreaks of crown rust (*Puccinia coronifera*) [*P. lolii*: *R.A.M.*, xiv, p. 747] on oats, while the latter two were relatively free from the disease. It was again confirmed that buckthorn (*Rhamnus cathartica*) is responsible for the primary infection of the crop in the spring [ibid., xv, p. 211], but no correlation could be established between the severity of the rust attack on the buckthorn and that on oats. Two critical periods were observed determining the intensity of attack on oats, the first of which coincides with the dissemination of the aecidiospores and extends from about the second ten days of May to the end of the first ten days in June; during this period heavy rainfall increases rust attack, while drought suppresses it even in the presence of very abundant infective material from severely rusted buckthorns. A second critical period, at the time of mass formation of the uredospores, was found to last from the third ten days of June to the end of the first ten days of July, corresponding to the stages from the beginning of ear formation to milky maturity of the oat grain; this period is of particular interest, since severe infection at this time leads to a considerable reduction in total yield and in the specific gravity of the grain.

The severity of attack by *P. lolii* on the buckthorn is also largely determined by weather conditions. Warm rains and fogs during the last half of March and the whole of April induce a high germination of the teleutospores before the leaves open and thus reduce infection, while a rigorous winter followed by a spring with warm rains towards the end of April promotes the germination of the teleutospores at the time the leaves open out, and therefore favours infection.

MUNDKUR (B. B.). **Oat leaf infection by Ustilago avenae (Pers.) Jensen.**—*Indian J. agric. Sci.*, v, 6, pp. 745–746, 1 pl., 1935.

On the oat varieties Early Champion, Danish, and Danish Island the loose smut *Ustilago avenae*, rather rare in India, is recorded as attacking the upper leaves, in which it formed sori in parallel striae accompanied by longitudinal shredding of the leaves [*R.A.M.*, iv, p. 664].

BORZINI (G.). **Ricerche sul 'carbone del Granturco' (Ustilago zeae (Beck) Unger).** [Researches on Maize smut (*Ustilago zeae* (Beck) Unger).]—*Boll. Staz. Pat. veg. Roma*, N.S., xv, 3, pp. 389–423, 1 fig., 4 graphs, 1935.

Investigations carried out in Rome in 1934–5 showed that fresh chlamydospores of *Ustilago zeae* [*R.A.M.*, vi, p. 307; xiv, p. 690; xv,

of the parasite may arise through hybridization. Environmental conditions were shown to have a considerable influence on the development of the smut, e.g., too intense or too low lighting in the greenhouse inhibited sporulation. This indicates the necessity of carefully adjusting experimental conditions so as to render them as similar as possible to those obtaining in the field.

RADEMACHER (B.). **Genetisch bedingte Unterschiede in der Neigung zu physiologischen Störungen beim Hafer (Flissigkeit, Dörrfleckenkrankheit, Urbarmachungskrankheit, Blattröte).** [Genetically conditioned differences in liability to physiological disturbances in Oats (blast, grey speck, reclamation disease, and leaf reddening).] —*Z. Zücht.*, A, xx, pp. 210–250, 3 figs., 2 maps, 1935.

A comprehensive, fully tabulated account is given of the writer's studies at the Kiel-Kitzeberg branch of the Biological Institute on the hereditary basis of the conditions predisposing oats to blast or English blindness [*R.A.M.*, xv, p. 11], grey speck [see next abstract], reclamation disease [ibid., xv, pp. 87, 145], and leaf reddening.

Although the development of blast is largely dependent on external conditions, such as weather, methods of cultivation, and place of origin of the seed, the degree of liability to the disturbance was found to differ considerably in the 111 varieties tested from 1929 to 1933 and must be regarded, therefore, as a fixed genetic character. Among the standard selections, those of the Probstei and Victory groups suffered most and the black moorland types least severely; among other resistant varieties may be mentioned Marktredwitz Fichtelgebirgs, Borries, Carstens IV, Peragis Early II, Mansholts, Kanota, Richland, *Avena strigosa*, and *A. byzantina*.

Of the 82 varieties examined for their reaction to grey speck from 1930 to 1933, none of the *A. sativa* group was entirely resistant, but marked differences in the virulence of the disease were observed, extreme susceptibility being shown, for instance, by Endress Franken, strong liability by v. Lochow's Yellow, Peragis Early II, and Richland, and a high degree of resistance by Svalöf's Glocken [Bell] III and Weibull's Argus; of the other *A.* spp. tested, *A. sativa orientalis pugnax* was very severely affected, *A. barbata*, *A. strigosa*, and *A. brevis* scarcely at all, and *A. byzantina* slightly. A correlation was observed between marked liability to blast (involving heavy water requirements) and a strong tendency to grey speck, but resistance to the former did not necessarily connote a similar reaction to the latter disturbance. A form of grey speck in which the typical lesions are replaced by carmine- to brownish-red, spherical, oval, or elongated areas with dark or light centres is characteristic of certain resistant varieties and appears to represent a defensive reaction on the part of the plant. In 1933 a number of varieties, after overcoming the characteristic symptoms of grey speck (a phenomenon usually observed some time before the close of the growing period), developed severe yellowing of the apical leaves and blindness of the panicles. Lodging was found to be prevalent among plants suffering from grey speck. For mildly affected soils there are quite a number of varieties that may safely be cultivated, but in dry seasons these types would probably fail on heavily diseased areas

and there is a wide field for breeding to combine resistance to grey speck with other desirable qualities.

Complete immunity is apparently no more to be expected in the case of reclamation disease than in that of grey speck, but a very high degree of resistance was shown by *A. strigosa*, while in the *A. sativa* group the black moorland types gave satisfactory results during the experimental period (1930 to 1933). The grey speck-resistant Swedish black was very susceptible to reclamation disease and all the white and yellow varieties tested, with the possible exception of P[ommersche] S[aatzucht] G[esellschaft] Gold, were more or less susceptible. Reclamation disease is not so exclusively associated with the juvenile stage of growth as grey speck, and the full extent of the damage from this source cannot as a rule be estimated until the close of the growing period. In the resistant moorland varieties the characteristic whitening of the tips is replaced by reddish lesions similar to those of the atypical form of grey speck. As in the case of grey speck, susceptibility to reclamation disease is to some extent correlated with hygrophytic properties, but the xerophytic types are by no means uniformly resistant. Support for the view that reclamation disease is a manifestation of copper deficiency is thought to be afforded by the higher yields in 1933 of original seed from mineral-containing soils as compared with those from the first year's progeny in which the reserves were already depleted, but this aspect of the problem requires further investigation. In connexion with the prospects of breeding for resistance to reclamation disease it is mentioned that certain crosses between Black Mesdag and standard German varieties which are immune from loose smut [*Ustilago avenae*: see preceding abstract] were little affected either by this trouble or grey speck.

Leaf reddening, first described by the writer in 1932 (*Arch. PflBau.* viii, p. 456, 1932), is characterized by a reddish-yellow to carmine spotting or striping of the leaves, beginning with the lowest and in severe cases extending to the haulm. The discoloured leaves twist spirally, turn a dirty brown to blackish-red colour, and die off, the process of destruction being finished by blackening fungi and moulds. Panicle production is retarded or suppressed. A fairly well-marked correlation was established between this disturbance and blast. Of the 52 varieties tested in 1929 and 1932 for their reaction to leaf reddening, the Probstei group suffered most, while certain black moorland types and others, including Weihenstephan Goten, Lüneburger Kley, and Carstens III, were little affected.

In conclusion the writer discusses the comparative reactions of the different varieties to the disorders under observation from the ecological and plant-breeding standpoints.

GERRETSEN (F. C.). **The effect of manganese deficiency on Oats, in relation to soil bacteria.**—*Trans. third int. Congr. Soil Sci.*, i, pp. 173–174, 1935.

Certain aspects of the grey speck disease of oats [see preceding abstract] do not appear to be explicable on the basis of manganese deficiency alone. Thus in Holland, when a manganese-deficient soil, on which the crop shows marked symptoms of grey speck, is sterilized with formalin, plants sown in the sterilized soil grow up healthy, although

grey spotting. The conditions are believed to arise from a gene mutation at some indeterminable period in the ancestry of the selections under observation.

The symptoms may develop at any stage in the growth of the plants, and in severe cases the foliar tissues undergo complete necrosis so that the leaves die off in succession. However, since each newly-formed leaf is capable of functioning for from two to three weeks according to external conditions, while the sheaths and haulms are also able to assimilate, the vital processes of the plant are not entirely impeded. The necrosis begins with a degeneration of the sclerenchymatous tissue, gradually extending over the whole mesophyll. In hereditary necrosis the loss of chlorophyll is heavier than in that due to yellow rust (*Puccinia glumarum*), and the degeneration sets in at a period when no external symptoms are discernible.

The occurrence of necroses of the foregoing types is strongly influenced by temperature; in *T. vulgare*, though not always in other species, their development is suppressed when a temperature of 15° C. persists for any length of time. Plenty of light is required to promote the extension of the necroses, which are little in evidence during the short days of December and January even under favourable temperature conditions. An adverse effect on the occurrence of these disturbances is further exercised by an excess of nitrogen and a complete absence of potash in the fertilizer. The optimum carbon dioxide concentration for the necroses is 0·3 per cent.; at 4·5 per cent. they are temporarily masked. These physiological data indicate that there is no apparent connexion between hereditary necrosis and grey speck [see below, p. 355] in spite of the similarity of the symptoms.

The simultaneous occurrence in a given variety of hereditary necrosis and *P. glumarum* may to some extent invalidate the usual technique of judging varietal reaction to yellow rust, more especially as the optimum temperatures for the development of both diseases coincide or overlap.

In Kolben wheat selections the inheritance of necrosis follows Mendelian laws. Experiments on the F_1 to F_4 generation showed that the condition is a simple recessive character transmissible by one nuclear gene. In addition to the factor pair *Nec nec* modifying factors would also appear to be operative. The disorder may entail a loss of grain ranging from 7 to 21 per cent. in Kolben wheat.

Dieudonné (P.) & Vanderwalle (R.). **Recherches sur la désinfection des semences d'Orge dans la lutte contre Ustilago nuda (Jensen) Rostrup.** [Studies on the seed disinfection of Barley in the control of *Ustilago nuda* (Jensen) Rostrup.]—*Bull. Inst. agron. Gembloux*, iv, 4, pp. 366–377, 1935. [Flemish, German, and English summaries.]

In studies on the control of loose smut of winter barley (*Ustilago nuda*) [*R.A.M.*, xiv, pp. 27, 296; xv, p. 8] treatment without pre-soaking was ineffective even at temperatures as high as 53° to 54° C. for periods of 20 minutes. A relationship was found to exist between the duration of the pre-soaking and immersion periods. Pre-soaking for 2 hours at 25° was efficacious when the subsequent treatment lasted

for 30 minutes at 50° or for 5 minutes at 52°. Pre-soaking for 2½ hours at 25° and subsequent treatment for 15 minutes at 50° was also satisfactory, while 5 minutes at 52° did not reduce germination. Pre-soaking for 3 hours at 25° and subsequent treatment for 10 minutes at 50° was also effective.

Immersion in 4 per cent. ethyl alcohol for 3 hours at 25° followed by 20 minutes' hot-water treatment at 45° gave complete control but markedly reduced germination. Treatment at 45° for 2 hours gave satisfactory disinfection but caused great diminution in the germinative capacity of the grain. Immersion at 45° for 1 hour in water containing 0·5 per cent. alcohol gave complete disinfection but also seriously reduced germination.

Nicolaisen (W.). **Untersuchungen mit Herkünften des Haferflugbrandes in Rahmen der Immunitätzüchtung.** [Experiments with collections of loose smut of Oats from the standpoint of breeding for immunity.]—*Z. Züchf.*, A., xx, pp. 318–345, 1935.

Following a reference to his earlier communication [*R.A.M.*, xiii, p. 364] on the breeding of oat varieties immune from loose smut (*Ustilago avenae*) and to Schattenberg's report on the preliminary work done in Halle in 1931–2 [ibid., xiv, p. 231], the author gives a tabulated account of the continued experiments there in 1933 and 1935, in which the reaction was tested of 29 oat varieties to 27 different collections (from individual oat varieties) of the smut which are prevalent in Germany. The results clearly demonstrated the extremely complex genetical constitution of the oat varieties from the standpoint of their reactions to the collections, no two varieties responding similarly to all the smut collections. In like manner the smut collections all differed from each other in their pathogenicity to the various varieties of oats. Some of the latter, such as Ferguson's Navarro, the Argentine La Estanzuela and Avena amarilla [yellow], Markton C.I. 2053, a local oat from Uruguay, Red Rustproof, Algerian, and Black Mesdag, showed varying degrees of high resistance (sometimes complete) to all the collections, and so offer very promising breeding material; a few others, however, which were also highly resistant or immune in the German tests, such as Fulghum and the Australian Gnyra, have been reported elsewhere as susceptible to certain strains of *U. avenae*, which considerably reduces their value in hybridization work.

In another table the results are summarized of infection experiments from 1929 to 1934, inclusive, with 19 collections of *U. avenae* on the four differential oat varieties Eckendorf Early, Petkus Yellow, Lischow's Early, and Gopher, followed by a detailed discussion of the pathogenicity of each smut collection tested. The results again confirmed the entirely different selective reaction of the oat varieties to the smut collections, and showed that the former are therefore very favourable material for the study of the nature of inheritance of resistance or susceptibility to the smut.

The work is considered to have shown the necessity in resistance tests of using as inoculum mixtures of as many smut collections as possible from a given region, including also the spores that are formed on the differential hosts in the experiments, since it is possible that new forms

in an inexpensive and convenient apparatus of considerable diagnostic utility.

De Mello (F.) & Mascarenhas (J.). **Levures et levuroses.** [Yeasts and diseases caused by them.]—*Arch. Esc. med.-cirurg. Nova Goa*, Ser. A, 10, pp. 1945–2032, 1935.

In the first part of this paper the authors, after referring to the difficulty of distinguishing adequately between true yeasts and yeast-like forms, summarize in considerable detail the information given by Guilliermond in his work 'Les levures' [Paris, 1912] on the biological problems related to these organisms.

In the second part [by de Mello] a full account is given, with numerous citations from the relevant literature, of the conflicting views of medical mycologists as to the status of many of the genera to which yeasts and yeast forms are referred. From a review of the evidence [which is discussed in detail] the author accepts the following genera as valid (1) *Candida* Berkhout, including most species of *Monilia* and some species of *Cryptococcus* [*R.A.M.*, viii, p. 676; xiii, p. 767; xv, p. 96]; (2) *Geotrichum* Link, emend. Cif. & Red. [ibid., xi, p. 476], which should include all those species of *Oidium* pathogenic to man, as well as *Mycoderma* sensu Vuillemin [ibid., xiii, p. 370]; (3) *Geotrichoides* Langeron & Talice [ibid., xiii, p. 767] for those forms with characters intermediate between the creamy colonies characteristic of *Monilia* [*Candida*] and the membranous ones characteristic of *Geotrichum*; (4) *Torulopsis* Berlese 1894, for *Torula* sensu Turpin, Pasteur, and Hansen [ibid., xiv, p. 192]; and (5) *Klöckera* Janke 1923 (identical with *Pseudosaccharomyces* Klöcker, 1912, rejected as a homonym) [ibid., xiv, p. 193], including the apiculate, asporogenous yeasts. No opinion is expressed as to the validity of the genus *Coccidioides*. The following are rejected: (1) *Monilia* Gmelin, because this designation should be restricted to fungi found on plants; (2) *Cryptococcus*, because it has been applied in so many different senses that it is responsible for most of the confusion in which the study of yeasts is involved; (3) *Blastodendrion* [ibid., xiii, pp. 370, 767] and *Mycelorrhyzodes*, because they are incompletely characterized and the distinction drawn by their author between mycelium and pseudomycelium is too unreliable to serve as a basis for a generic classification; (4) *Oidium* Link, a term which should not be used in medical mycology, as the type species *O. monilioides* differs from *O. lactis* with the result that the medical sense given to the genus by Vuillemin, Pinoy, and others is quite different from the original phytopathological one; (5) *Torula* Pers., because it is used for *T. monilis*, a Dematiaceous fungus, and cannot be employed sensu Turpin, Pasteur, and Hansen. Ciferri's and Redaelli's classification, being based on occasionally inconstant characters, is not accepted in its entirety. *Blastomycoides* Cast. is rejected because it is synonymous with older, incomplete, and badly characterized genera, and is based on imperfect botanical characters and tissue changes in the host. Langeron's and Talice's classification [ibid., xi, p. 476] introduces specific characters into a generic definition, and the new genera established by them (*Mycocandida* and *Mycotoruloides*) are therefore rejected, the same observation applying to *Neogeotrichum* Magalhães.

In the third section of the paper [by de Mello and collaborators] the authors give a concise classification of the diseases of man caused by yeasts, arranged according to the site of infection. Details are given of a species of *Geotrichum* (No. 1) isolated from a case of intertrigo, and a number of unidentified species of *Candida*, No. 1 isolated from multiple, verrucose, or pustular ulceration of the leg, Nos. 2 to 9 associated with bronchial disease, Nos. 10 and 11 associated with enteritis and two (unnumbered) from two pulmonary cases.

Dodge (C. W.). **Medical mycology. Fungus diseases of men and other mammals.**—900 pp., 142 figs., London, H. Kimpton, 1936. Price £2 2*s*. net.

For the first time, the whole of the literature dealing with medical fungi up to the end of 1933 has been brought together into one book. The bibliography, which cites probably more than 4,000 titles, occupies some 167 pages, and the author has made a point of checking the dates of publication of all the papers which contain valid publication of new genera, new species, and new combinations. The book opens with short chapters on the morphology and physiology of fungi, culture media, and methods of isolation, and then one on botanical nomenclature as governed by the international rules; as the rules and recommendations passed in 1930 were not published in time, use has been made of an unofficial version.

The systematic account starts with the Mucorales; *Mucor*, *Absidia*, *Rhizopus*, and *Mortierella*. A brief chapter (viii) introduces the reader to the Ascomycetes, considered mainly in reference to their cytology, while Chapters ix to xiv are devoted to the Endomycetales, the classification followed being apparently an elaboration of that presented in Gäumann's and Dodge's 'Comparative Morphology of Fungi' [*R.A.M.*, vii, p. 591]. Chapter xi, under the title Eremascaceae Imperfectae, includes a considerable number of genera which the author anticipates will finally be proved to belong to the Eremascaceae. *Candida* Berkhout, to which the author refers *Geotrichoides* Langeron and Talice, comes here together with its numerous associates and derivatives: *Monilia* (attributed to Bonorden) is also included, and the *Monilia* species of the plant pathologists are accordingly excluded from the genus [see preceding abstract]. Chapter xii reviews the Saccharomycetaceae and Chapter xiii the Saccharomycetaceae Imperfectae. Chapter xiv is devoted to the genus *Malassezia* and the bibliography of all the Endomycetales; unfortunately the printer has attributed all the literature to the single genus. Chapter xv introduces the Plectascales and the family Gymnoascaceae, and xvi the Trichophytoneae, which are considered by the author to be probably imperfect stages of the Gymnoasceae. This last group, which includes the common ringworm fungi, comprises the genera *Trichophyton*, *Microsporon*, *Achorion*, *Epidermophyton*, *Endodermophyton*, *Pinoyella*, *Ectotrichophyton*, *Megatrichophyton*, and *Favotrichophyton*. Chapter xvii is devoted to the Aspergillaceae (*Aspergillus*, *Penicillium*, &c.). Among the general Fungi Imperfecti, included at the end of the book, may be noted the Torulae (Chapter xix), the Actinomyceteae (Chapter xx) and the Sporotricheae (Chapter xxi).

which, however, was greatly complicated by the phenomenon of polyembrony and by lack of vigour of the hybrids raised.

Inoculation tests were first made by inserting mycelium of the fungus through holes in the bark; the organism grew in the cortical tissues of the immune *nobilis* varieties, though less rapidly than in those of the susceptible kinds [ibid., x, p. 98]. This method, however, is unsuitable for the determination of individual reaction to *P. parasitica*, and inoculations by means of zoospores resulted in only 3 per cent. infection even on susceptible varieties. An attempt was then made to increase the extent of infection occurring under natural conditions by the inoculation of the soil surrounding the stem bases. During the four years since the commencement of this experiment there have been no cases of gummosis among the grafted trees, but it is pointed out that a period of six to eight years must elapse before the final trials for immunity with promising material can be undertaken. Several of the hybrids from crosses made in 1929, however, have already contracted the disease (*C. hybridus*×*C. sinensis*, *C. hybridus*×*C. nobilis*, and *C. hybridus*×*C. aurantium*), denoting the possibility that immunity among F_1 stocks is not to be anticipated, and that further tests in the F_2 are requisite.

Reed (H. S.) & Frémont (T[hérèse]). **Étude physiologique de la cellule à mycorrhizes dans les racines de Citrus.** [A physiological study of the mycorrhiza cell in Citrus roots.]—*Rev. Cytol. et Cytophysiol. vég.*, i, 4, pp. 327–348, 8 figs., 1935.

Further studies in California of the mycorrhizal infection of citrus trees [*R.A.M.*, xv, p. 90] showed that affected roots contain abnormal amounts of starch in the uninfected cells. This becomes apparent immediately the roots are infected, even in cells far removed from those affected. Directly, however, the mycelium enters a cell all trace of starch disappears.

Lipoidal precipitates are constantly present in the mycelium and in infected and uninfected root cells, but mostly in the superficial layers of the cortex, where infection seldom occurs. All pathological conditions apparently favour the development of these precipitates, and possibly the presence of the endophyte may sometimes be a remote cause of their development, while in some cases a fatty degeneration of the mycelium may liberate large amounts of fat in the cell; this was observed in roots kept in the laboratory. Oxidase was found to be more abundant in infected than in non-infected plants.

It is concluded that in citrus roots the mycorrhiza cell is essentially an unstable association. The resistance or susceptibility of the host cell depends on soil fertility, type of fertilizer, irrigation, and weather conditions, and the more lasting and more well-balanced the association the more effective it is from the point of view of plant nutrition. As the fungus is invariably eliminated sooner or later the mycorrhizal cell is an example of a resistance that develops after a state of extreme susceptibility.

Mitra (M.) & Kheswalla (K. F.). **The effect of temperature on the growth of Fusarium vasinfectum Atk.**—*Proc. Indian Acad. Sci.*, **ii**, 6, pp. 495–499, 1 graph, 1935.

A study on the influence of temperature on the growth of monospore

cultures of the cotton wilt strain of *Fusarium vasinfectum* [*R.A.M.*, xiv, p. 358] isolated at Dharwar showed that the optimum temperature for growth on solid and liquid media is about 25° C., the minimum a little below 13° to 14°, and the maximum apparently between 35° and 40°.

Afzal (M.), Jaggi (S. S.), & Singh (B.). **A note on a survey of the disease of malformation in the Punjab-American Cottons.**—*Indian J. agric. Sci.*, v, 5, pp. 624–631, 1935.

In a survey of all the important cotton-growing areas of the Punjab it was found that while the disease tentatively identified as stenosis [*R.A.M.*, xiii, p. 438; xiv, p. 561] is serious in the neighbourhood of the Punjab Agricultural College Estate, it is of no consequence in the other parts of the province. The type of soil seemed to exert a remarkable effect on the disease in one experiment, the varieties L.S.S., 38 F, and 45 F showing 20·26, 20·16, and 20·61 per cent. infection, respectively, on rich land, and 3·02, 4·92, and 4·92 per cent. on light land. Seed from small-sized bolls on affected plants failed to transmit the disease to the progeny.

Dósa (A.). **Über das Trichophyton gypseum persicolor an Hand von 'Herpes tonsurans' und 'Eksema dysidroticum'—Fällen.** [On *Trichophyton gypseum persicolor* accompanying cases of 'herpes tonsurans' and 'eczema dysidroticum'.]—*Arch. Derm. Syph., Berl.*, clxxiii, 4, pp. 385–387, 2 figs., 1936.

Trichophyton gypseum persicolor [*T. persicolor*: *R.A.M.*, xv, p. 296] was recently isolated from two patients at the Clinic for Skin Diseases, Franz Josef University, Szeged (Hungary), and formed on maltose agar oval, angular, stellate, or irregular, furcate colonies, sometimes with serrated margins, with a protuberant, butter-yellow centre merging into mauve or peach-colour towards the periphery, near which a dark, concentric stripe developed after the third week. Striking modifications of these characters were apparent in subcultures. In hanging drops few free conidia were observed and these organs were also only sparsely formed, sometimes in botryose clusters, on the sides of the frequently curved hyphae of variable diameter; numerous plurilocular spindles were detected, however, together with aggregations of arthrospores. The patients reacted positively to injections with trichophytin vaccines. The fungus was not highly pathogenic, inoculations on guinea-pigs giving negative results, and cures were readily effected by appropriate treatments.

Davidson (A. M.), Boyd (S. A.), & Haltalin (C. P.). **An improved source of ultra-violet light for the diagnosis of ringworm of the scalp.**—*Canad. med. Ass. J.*, xxxiii, pp. 534–536, 1 fig., 1 diag., 1935.

Technical details are given of certain improvements made in the portable lamp produced in 1932 by Davidson and Gregory as a source of 'Wood's light' for the detection in human and animal hair of organisms becoming fluorescent on exposure to filtered ultra-violet rays, e.g., *Microsporon audouini*, *M. lanosum*, and *Achorion schoenleini* [*R.A.M.*, xii, p. 23]. The modifications in question are stated to have resulted

2·5 to 4·2 μ. Positive results were given by inoculation experiments with the fungus (which is believed to be closely related to *Glomerella cingulata*) [*R.A.M.*, xiv, p. 596 and next abstract] on papaw, chilli pepper (*Capsicum annuum*), guava, *Averrhoa carambola*, *Hibiscus sabdariffa*, avocado (*Persea americana*), sand pear (*Pyrus calleryana*), banana, orange, lemon, *Anona squamosa*, and *Citrus erythrosa*, in addition to its natural host. The conidial dimensions ranged from 5 to 8·95 by 2·5 to 3 μ (on banana) to 12·5 to 17·5 by 2·5 to 4·5 μ (on guava).

PALO (M. A.). **Notes on mottle-leaf and anthracnose fruit spot of Citrus in Bukidnon.**—*Philipp. J. Agric.*, vi, 4, pp. 497–500, 2 pl., 1 fig., 1935.

The most serious citrus disease in Bukidnon, Philippine Islands, is mottle leaf [*R.A.M.*, xv, p. 146] to which, of the commercial varieties generally grown locally, sweet orange is the most susceptible, followed by pomelo and mandarin. The disease killed several trees in two localities and reduced the yield in two others. The marked decline of yield on a number of citrus farms is attributed primarily to it. Control by applications of zinc sulphate is recommended.

Pomelo fruits in the same locality are commonly attacked by anthracnose due to the *Gloeosporium* stage of *Glomerella cingulata* [see preceding abstract]. The affected fruits, which are attacked in all stages of development, bear a few sunken, circular, orange-cinnamon spots, 5 to 40 or more mm. in diameter, sometimes accompanied by a clear, yellowish exudate which, if not washed off by rain, hardens into a transparent ochraceous-buff to ochraceous-tawny mass. Under favourable weather conditions, pinkish masses of fructifications develop, sometimes in concentric rings. In prolonged wet periods the spots spread rapidly and may cover entire fruits, while in dry weather their development is hindered, and they become hard and dry. The rind, locules, and core are attacked and badly affected fruits fall. The incidence of the disease appears to be favoured by the local climate and rainfall. Weakened trees are the most susceptible. Control consists in destroying affected material and spraying with Bordeaux mixture immediately before flowering, when most of the fruits have set, and again three weeks later.

PUTTERILL (V. A.). **Citrus wastage investigations. Progress Report No. 3. Season 1934.**—*Bull. Dep. Agric. S. Afr.* 149, 27 pp., 1 fig., 1 graph, 1935.

The results of further investigations in South Africa into mould [*Penicillium digitatum*] wastage in Navel oranges [*R.A.M.*, xv, p. 291] showed that at Zebediela the number of mouldy fruits removed at grader intake and during grading and packing approximated to one fruit in every four lug boxes. At Grahamstown the corresponding figure was 1 wasty fruit per 20 lug boxes, ranging according to the source of the oranges from 1 fruit in 6 to 1 fruit in 152 lug boxes.

Fruit graded and packed at the beginning and end of the day's work at Zebediela showed, respectively, 7 and 15 per cent. waste 21 days after arrival in England, this difference being attributed to increased contamination of the plant during the day's operations. Evidence was obtained of the necessity of disinfecting lug boxes (with 2½ per cent.

formalin) before being sent to the groves to be filled. Oranges packed after 0, 5, and 10 days' wilting averaged after arrival in England, 2, 3, and 10 per cent. waste, respectively, demonstrating that packing without wilting was not detrimental.

Oranges dipped at Zebediela, 3, 9, and 24 hours after picking in 6·8 per cent. borax [ibid., xv, p. 292] solution for 1 minute at 100° to 110° F., showed, 14 days later, 0, 0·3, and 0·2 per cent. infection, as against 0·6, 0·9, and 0·5 per cent. for the controls. In fruit-washing tests with injured and inoculated fruit at Grahamstown the best results were given by 1 minute's immersion in 8 per cent. borax and the next best by similar treatment with 2 per cent. caustic soda, the figures being, respectively, 8 and 25 per cent. waste for fruits washed 72 hours after being injured and 6 and 22 per cent. in another experiment with oranges washed within an hour or two of being inoculated. When oranges before dispatch to England were washed in 1 per cent. caustic soda for 3 minutes at 95° to 100°, only 18 per cent. waste developed, as compared with 33 per cent. in the untreated controls. At temperatures of 125° to 130°, 4 per cent. sodium carbonate and 4 per cent. borax gave 55 and 56 per cent. waste, respectively, but at 40° to 110°, sodium bicarbonate was more effective than borax.

Smith (F. E. V.). **Wither-tip or anthracnose disease of Citrus trees.**—*J. Jamaica agric. Soc.*, xl, 1, pp. 50–52, 1936.

Citrus wither-tip or anthracnose, always present in many parts of Jamaica, was prevalent in 1935 in the Linstead District of St. Catherine. The fungus most commonly associated with the trouble is *Colletotrichum gloeosporioides* [*R.A.M.*, xiv, p. 755; xv, p. 136], but in some cases *Diplodia natalensis* and *Phomopsis* [*Diaporthe*] *citri* also occur. *C. gloeosporioides* under certain circumstances produces a stem-end fruit rot, but the fungus is not a vigorous parasite and is injurious only to weakened plants; in fact wither-tip frequently develops without any fungus at all being present in the early stages. The wither-tip symptoms are usually commonest in young budded trees one to five years old. Trees of this age frequently show a lack of balance between the root stock and scion, and this generally results in a coarse, sappy growth, readily susceptible to wither-tip. The condition is frequent on heavy, ill-drained soils and on over-manured plants. It is most prevalent in autumn, when the seasonal rains begin. In most cases, provided the plant is carefully looked after and not over-nourished, the disease disappears completely when the tree is five or six years old and the root stock and scion have become more balanced. Improved cultural practices are recommended for purposes of control.

Toxopeus (H. J.). **Die Züchtung von Unterlagen für Citrus sinensis Osb. immun gegen Phytophthora parasitica, die Ursache der 'gum-disease' in Java.** [The breeding of stocks for *Citrus sinensis* Osb. immune from *Phytophthora parasitica*, the agent of 'gum disease' in Java.]—*Züchter*, viii, 1, pp. 1–10, 1 fig., 1 diag., 1 graph, 1936.

A tabulated account is given of the writer's experiments in Java in the breeding of stocks for sweet oranges (*Citrus sinensis*) immune from *Phytophthora parasitica* [*R.A.M.*, xiv, p. 301; xv, p. 213], the work on

tracheiphila [*R.A.M.*, xiv, p. 680; xv, p. 291], is stated to be morphologically and biologically distinct from the other lemon varieties grown in Sicily. It is supposed to be a hybrid between the ordinary lemon and lime [*Citrus medica*], but its chromosome content (9) has been found to be similar to that of other citrus varieties and the question of its hybrid nature must remain open pending further investigations.

Biraghi (A.). **Rilievi su alcuni Citrus a frutto acido presenti in India in relazione alla ricerca di forme resistenti al 'mal secco'.** [Notes on Citrus varieties with acid fruit found in India in relation to the search for types resistant to 'mal secco'.]—*Boll. Staz. Pat. veg. Roma*, N.S., xv, 3, pp. 424–441, 1935. [English summary.]

A survey conducted in the northern and western regions of India to collect indigenous forms of lemons to be tested for resistance to mal secco (*Deuterophoma tracheiphila*) [see preceding abstract] showed that lemons are very scarce in India, limes (*Citrus aurantiifolia*) being used in their place. Many indigenous forms of citron (*C. medica*) were noted, but plants with all the characters of the lemon were found only in the Botanical Gardens of Saharanpur, United Provinces. Most of the forms of citrus that bear fruits with a yellow rind and sour juice have morphological characters intermediate between those of the lime and the lemon and must, apparently, be grouped separately. The results of the survey do not support De Candolle's view that India is the home of the lemon. No evidence of the presence of *D. tracheiphila* was found in India, but die-back of limes (*Colletotrichum gloeosporioides*) [*R.A.M.*, xiv, p. 692] was prevalent and a non-parasitic wilt of citrus due to insufficient depth of soil was also observed.

Weindling (R.) & Fawcett (H. S.). **Experiments in the control of Rhizoctonia damping-off of Citrus seedlings.**—*Hilgardia*, x, 1, 1–16, 4 figs., 1936.

In laboratory, greenhouse, and field experiments carried out in California [a preliminary account of which has already been noticed: *R.A.M.*, xiv, p. 188], damping-off of citrus seedlings caused by *Rhizoctonia* [*Corticium*] *solani* was successfully controlled by acidifying the soil layers next to the seed by applying aluminium sulphate or acid peat moss. This produced an initial reaction of about P_H 4. The condition was not, however, controlled in sterilized soils of the same acidity in the absence of *Trichoderma* spp. [cf. above, p. 395] and the evidence obtained indicated that the decisive factor was a change in the soil microflora favouring organisms such as *Trichoderma*, which may be antagonistic to *C. solani*. The peat moss applications had a stunting effect on most of the seedlings, but the aluminium sulphate treatment showed promise as a practical means of commercial control.

Jenkins (Anna E.). **Present generic status of the Citrus-scab organism.**—*Phytopathology*, xxvi, 1, pp. 68–70, 1 fig., 1936.

The writer compared parallel cultures of the citrus-scab organism named by her *Sphaceloma fawcettii* [*R.A.M.*, iv, p. 477] in 1925 with those of *Sporotrichum schenckii*, the first animal pathogen to be placed in the genus *Sporotrichum*, to which Miss Doidge and E. J. Butler

referred the fungus of citrus scab [as *S. citri*: ibid., iv, p. 164] in 1924. *Sphaceloma fawcettii* differed markedly from *Sporotrichum schenckii* [ibid., xv, p. 294] in its slower growth, much brighter colour (a feature in which it resembles *Elsinoe ampelina*) [ibid., xiv, p. 557], its rapidly developing, irregularly convolute colony (whereas cultures of *S. schenckii* remained devoid of convolutions for at least seven days), and in general appearance. It is shown in a forthcoming paper that *E. ampelina* is innocuous to rabbits, and there seems no reason, on the basis of these studies, to postulate a close relationship between the citrus pathogen and *S. schenckii*. *S. roseum*, regarded as the type of the genus by Clements and Shear, is clearly not related to *Sphaceloma fawcettii*.

JENKINS (ANNA E.). **A Sphaceloma on fruit of Hesperethusa crenulata, a remote Citrus relative from India.**—*Phytopathology*, xxvi, 1, pp. 71–73, 1 fig., 1936.

Hesperethusa crenulata (Roxb.) Roemer, a remote relative of the citrus family belonging to the tribe Triphasinae, was not found to be affected by scab (*Sphaceloma fawcettii*) [see preceding abstract] by Winston and his collaborators in Florida [*R.A.M.*, v, p. 29], but there is a previous record of the disease on fruits of this host (erroneously labelled *Limonia acidissima*) received by W. T. Swingle from the Royal Botanic Gardens, Sibpur, near Calcutta, in February, 1916. The roughly circular, raised or convex, sharply delineated lesions on the enlarged fruits bear in the centre dark, punctiform masses of microconidia and acervuli. The symptomatological features of the disease on *H. crenulata* bear a certain resemblance to those induced on sweet oranges in South America by *S. fawcettii* var. *viscosa* [ibid., xiv, p. 816], but further critical study is necessary to determine the exact systematic position of the organism concerned.

MARCHIONATTO (J. B.). **Argentine Republic : experiments on the control of scab of Citrus fruits.**—*Int. Bull. Pl. Prot.*, x, 1, pp. 1–2, 1936.

Sporotrichum citri [or *Sphaceloma fawcettii*: see preceding abstracts] was determined as the agent of typical markings diminishing the commercial value of citrus fruits in the Concordia district of Entre Ríos, Argentine [*R.A.M.*, xiii, p. 437], the mites constantly accompanying the lesions being without significance. Satisfactory control of the disease was obtained in K. Hayward's experiments by two applications of Bordeaux mixture combined with white emulsible oil, the first being given 15 to 30 days before flowering and the second after petal-fall.

LI (L. Y.). **Anthracnose of Hwangpee, Clausena lansium (Lour.) Skeels, in South China.**—*Lingnan Sci. J.*, xv, i, pp. 113–117, 4 figs., 1936. [Chinese summary.]

Hwangpee (*Clausena lansium*) [a remote relative of *Citrus*] in the Canton district of China was observed in June, 1935, to be severely attacked by an anthracnose disease estimated to affect 15 per cent. of the fruit on the local wholesale market. From the greyish-brown to black lesions, 1 to 1·5 cm. in diameter, bearing concentric rings of acervuli, the writer isolated a *Gloeosporium* with conidia 10 to 16·2 by

The book is a mine of information about these highly contentious organisms, and will be quite indispensable to all workers who have to deal with them.

OLEYNIKOVA (Mme V. M.). Болезни Льна основных льноводных районов Восточносибирского края. [Flax diseases in the principal Flax-growing regions of East Siberia.]—*Тр. Защ. Раст. вост. Сибири* [*Bull. Pl. Prot. East Siberia*], 2(4), pp. 289–305, 1 graph, 1935.

After referring to the rapid development of flax-growing in East Siberia as an industry, the author gives an annotated list of the pathogenic and semi-parasitic fungi (16 species) which she found on flax in that country during a preliminary survey in 1932. Subsequent observations showed that of these organisms *Colletotrichum lini* [*R.A.M.*, xiv, p. 763] alone causes important annual losses (estimated on the average at 30 per cent. of the crop); its incidence all over the country ranges between 60 and 100 per cent. of the flax stands, fields with 85 to 95 per cent. infection being the general rule. The fungus was found attacking the host at all the stages of its development, from the emergence of the cotyledons upwards, and it caused serious deterioration of the textile qualities of the fibres. Rust (*Melampsora lini*) [ibid., xiv, p. 309] is stated to have been introduced from Russia proper with flax seed, but so far it has not been observed to cause considerable damage to the local flax varieties, though in 1933, a year very favourable to fungal diseases, it was recorded from many localities, and its further development in the country should be carefully watched, because of its potentialities. Among other diseases of minor local importance mention may be made of wilt (*Fusarium lini*) [ibid., xiv, p. 763], browning or stem-break (*Polyspora lini*) [ibid., xv, p. 158], and those caused by *Ascochyta linicola* [ibid., xi, p. 647], *Botrytis cinerea* [ibid., xii, p. 372], *Mycosphaerella linicola* [ibid., vii, p. 446], *Erysiphe cichoracearum* [ibid., xiii, p. 515], and *Helminthosporium linicola* [ibid., ix, p. 720], of which the two first-named deserve further study. While *F. lini* only appeared to attack flax plants debilitated by other causes, a serious seedling blight, chiefly characterized by a rapidly developing girdling of the stem at soil level, resulting in the plant falling over at that point and dying in one or two days, was observed in some localities to be caused by a species of *Fusarium* differing morphologically from *F. lini*; this organism is now being studied.

In varietal disease resistance tests none of the local varieties of flax tried was wholly resistant to *C. lini*, but the six varieties 1191, 8233, 0266, 0258, 1125, and Alpha, showed only a relatively low degree of susceptibility; these varieties, however, were all highly susceptible to rust, while the varieties resistant to the rust were all highly susceptible to *C. lini*.

BAUDYŠ (E.). **Nejdůležitější choroby a škůdci Jiřín.** [The more important diseases and pests of Dahlia.]—*Publ. fytopath. Sekce zemsk. výzk. Ust. zeměd. Brno* [*Publ. phytopath. Sect. reg. agric. Exp. Sta. Brno*] 149, 7 pp., 7 figs., [?] 1935. [Received February, 1936.]

This is a brief, popular account of the more important pests and diseases of dahlia so far recorded from Czecho-Slovakia, among

which the following cause the greatest damage to the growing plant: damping-off of seedlings and young cuttings (due to a number of fungi including *Phytophthora omnivora*, *Thielavia basicola*, *Moniliopsis aderholdi*, and *Rhizoctonia* [*Corticium*] *solani*), crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xiii, p. 517], *Verticillium dahliae* [ibid., xii, p. 26; xv, p. 99], wilt (due to various species of *Fusarium*, especially *F. roseum* and *F. georginae* [cited by Wollenweber as synonymous with *Colletotrichum atramentarium*]), *Sclerotinia sclerotiorum* [ibid., iii, p. 40], and *Botrytis cinerea* [ibid., xii, p. 25] which rapidly rots the inflorescences under humid conditions. Other records are *Entyloma dahliae* [ibid., xiii, p. 655], first introduced into Moravia in 1926, *Erysiphe communis* [*E. polygoni* sensu Salmon], *Phyllosticta dahliaecola*, and *Cercospora grandissima* [ibid., xiv, p. 472], the last-named of which was imported into the country from Brazil. Stored tubers are attacked by a number of fungi, including several species of *Fusarium* and *Acrostalagmus cinnabarinus*. Control measures are briefly indicated in every case.

Elssmann (E.). **Der Löwenmaulrost und die ungelöste Frage seiner Bekämpfung.** [Snapdragon rust and the unsolved problem of its control.]—*Blumen u. PflBau ver. Gartenwelt*, xl, 3, pp. 30–31, 2 figs., 1936.

According to Poeverlein (in correspondence) the rust of *Antirrhinum majus* (*Puccinia antirrhini*) [see next abstracts] continued to spread widely in Germany in 1935, when it travelled eastwards through Silesia to Czecho-Slovakia, the spores being presumably disseminated by wind. The seed of *A. majus* has been found to be extremely sensitive to liquid disinfectants, half-an-hour's immersion in 0·25 per cent. uspulun or ceresan causing a serious reduction of germination which did not follow the use of ceresan or abavit B dusts.

Andres (H.). **Der Antirrhinum-Rost (Puccinia antirrhini Diet. et Holw.) in Westdeutschland. II.** [The *Antirrhinum* rust (*Puccinia antirrhini* Diet. & Holw.) in western Germany. II.]—*Ann. mycol., Berl.*, xxxiii, 5–6, pp. 353–356, 1935.

The writer gives further details of the intensely severe outbreak of *Antirrhinum* [*majus*] rust (*Puccinia antirrhini*) previously reported in western Germany [*R.A.M.*, xiv, p. 364; xv, p. 227], the origin of which is entirely obscure and likely to remain so. No sign of seed or corolla infection has so far been observed, nor is any evidence forthcoming that the rust is heteroecious. The fungus behaves very capriciously, now appearing to prefer the red varieties and at other times the white ones [cf. next abstract], while its mode of spread is also eccentric. It survives severe frosts and is apparently unaffected by burning sunshine, gales, and the like. Variations in teleutospore characters as determined by Prof. Dietel [loc. cit.] are given for material from four localities, including Grignon (France) [ibid., xiii, p. 269].

Buchwald (N. F.). **Løvemundsorternes Modtagelighed for Rust (Puccinia antirrhini).** [Varietal susceptibility of Snapdragons to rust (*Puccinia antirrhini*).]—*Gartnertidende, 1936*, 4, pp. 45–49, 3 figs., 1936.

A tabulated account is given of the writer's investigations in seven

localities of Denmark [*R.A.M.*, xiv, p. 239], including Copenhagen and its environs, of the susceptibility of varieties of *Antirrhinum majus* (arranged in seven groups) to *Puccinia antirrhini* [see preceding and next abstracts]. Broadly speaking, the majority of the yellow- and white-flowered varieties, e.g., Gold Monarch, Giant Yellow, Queen of the North, and Pure White, are fairly resistant to rust, the percentages of slightly susceptible types within the two categories being 60 and nearly 90, respectively [ibid., xiii, p. 704; xiv, p. 172]. The pink, red (various shades), and variegated classes, on the other hand, tend to a higher degree of susceptibility, the percentages of moderately resistant sorts within them being only 36, 30, and 23, respectively.

STEINER (H.). **Der Löwenmaulrost (Puccinia antirrhini) auch in Österreich.** [The Snapdragon rust (*Puccinia antirrhini*) also in Austria.] —Reprinted from *Gartenztg, 1936*, 2 pp., 4 figs., 1936.

In connexion with the recent (November, 1935) detection of snapdragon (*Antirrhinum*) [*majus*] rust (*Puccinia antirrhini*) [see preceding abstracts] in some Viennese nursery-gardens, the writer gives a semi-popular account of the distribution, etiology, and symptoms of the disease, with indications for its control based on the experience of workers on the same problem in other countries.

GALLOWAY (L. D.) & SEN (R. R.). **An unusual rust fungus on Tulip.**— *Indian J. agric. Sci.*, v, 6, pp. 743–744, 1 pl., 1935.

The authors record the occurrence of *Puccinia prostii* on a leaf of *Tulipa* sp. received from Baluchistan in May, 1935. The very characteristic spiny teleutospores measured 44 to 66 by 30 to 46 μ.

FLACHS (K.). **Krankheiten and Schädlinge an Kakteen.** [Cactus diseases and pests.]—*Nachr. SchädlBekämpf., Leverkusen*, x, 4, pp. 184–193, 13 figs., 1935. [English summary.]

Semi-popular notes are given on the following diseases of Cactaceae: *Phytophthora cactorum*, the agent of wet or black rot, chiefly of *Cereus* and *Melocactus* spp. in Germany [*R.A.M.*, vii, p. 581; xi, p. 651] (controllable, when recognized in the incipient stage, by excision of the infected parts and disinfection with a 0·25 per cent. solution of uspulun or ceresan); *Helminthosporium cactivorum* [ibid., x, p. 798], which attacks *Cereus*, *Echinocactus*, and *Mamillaria* spp., and was found by the writer severely infecting young plants from Mexico in 1933; *Botrytis cinerea*, affecting the same species and *Opuntia* (amenable to spraying with 2 per cent. Bordeaux mixture or soft soap); and *Moniliopsis aderholdi* [ibid., xii, pp. 97, 448] on seedlings and cuttings (for the control of which soil disinfection with ceresan or uspulun and repeated spraying of the plants with 1 per cent. copper sulphate are recommended in addition to appropriate cultural measures). *O.* spp. are also subject to invasion by *Sclerotium cacticola* (in Holland) [ibid., xii, p. 634]; *Bacillus cacticidus* [ibid., v, p. 304]; *Pseudomonas* [*Bacterium*] *tumefaciens* [ibid., xiv, p. 39]; *Gloeosporium opuntiae* (in the United States); *Phyllosticta opuntiae* (in Italy); and scab caused by a species of *Melanops*, *Botryodiplodia*, or *Dothiorella* (on *O. diademata* var. *papyracantha* in Czecho-Slovakia) [ibid., x, p. 799]. *Pythium de Baryanum* occurred on

young *Cereus* plants in Italy in 1931. Other diseases of minor importance include *G. cerei* on *Cereus*, *G. cactorum* on *Mamillaria*, *Septoria cacticola* and *Phoma cereicola* on *Cereus*, and *P. melocacticola* on *Melocactus*. Pape has reported mosaic on cactus in Germany [ibid., xii, p. 570], where the plants also occasionally suffer from physiological disturbances, e.g., 'corkiness', manifested by green or rusty-yellow spots on the leaves, and chlorosis, in which yellow or brownish-green shoots replace those of a normal colour.

Nicolas (G.). **Phillyrea media L. et Zaghouania phillyreae Pat.** [*Phillyrea media* L. and *Zaghouania phillyreae* Pat.]—*Bull. Soc. Hist. nat. Afr. N.*, xxvi bis, pp. 45–47, 1935.

In further studies made on *Zaghouania phillyreae* [*R.A.M.*, xiii, p. 717] on *Phillyrea media*, in Toulouse, the author observed that tumours produced by the fungus on the branches showed the presence of uredosori frequently covered with mycelium bearing white, elongated, slightly arched conidia tapering at the extremities, containing four (occasionally up to seven) cells, and measuring 29 to 33 by 2·8 to 3 μ. Some of the uredospores were discoloured and deformed and the white mycelium, which is probably parasitic, is thought to belong to *Fusarium uredinicolum*.

Servazzi (O.). **Uropyxis sanguinea (Peck.) Arth., la ruggine americana della Mahonia in Italia.** [*Uropyxis sanguinea* (Peck.) Arth., the American *Mahonia* rust in Italy.]—*Difesa Piante*, xii, 6, pp. 189–191, 1 pl., 1935.

In June, 1933, the author observed at Biella *Mahonia* [*Berberis*] *aquifolium* showing heavy infection by *Uropyxis* [*Cummunsiella*] *sanguinea* [*R.A.M.*, xv, p. 230], not previously recorded in Italy. The abundant uredospores measured 25 to 33 by 16 to 19 μ, and the teleutospores, produced in limited numbers, 30 to 35 by 18 to 20 μ with a pedicel 100 to 165 by 3 to 4 μ. No accidia were observed. The fungus was subsequently observed in Turin and Chieri, and the author considers that it is probably widely prevalent in northern Italy.

Klinkowski (M.). **Schädlinge und Krankheitserscheinungen der Serradella.** [Pests and disease phenomena of Serradella.]—*Mitt. Landw., Berl.*, li, 1, pp. 12–13, 4 figs., 1936.

Serradella [*Ornithopus sativus*] in Germany is stated to be liable to a wilt disease caused by a species of *Fusarium*, a root rot due to *Rhizoctonia*, and chlorosis resulting from soil acidity [*R.A.M.*, iv, p. 603; cf. also xiv, p. 255], the last-named being the most important and necessitating treatment by timely applications of lime in appropriate amounts to induce a reaction of P_H 5·8 to 6·8, the optimum for the growth of the crop.

Bělař (E.). **Škody způsobené chorobami a škůdci na pícních rostlinách a jak jim čeliti.** [Damage caused by diseases and pests to fodder plants and how to control them.]—*Publ. fytopath. Sekce rostl. výzk. Úst. zeměd. Brno* [*Publ. phytopath. Sect. reg. agric. Exp. Sta. Brno*] 152, 6 pp., 1935.

This paper gives brief practical instructions for the control of the

most important bacterial and fungal diseases (and also insect pests) which attack a wide range of crops grown for fodder in Czecho-Slovakia (including maize, sorghum, *Panicum miliaceum*, peas, broad beans (*Vicia faba*), vetch, lupins, clovers, lucerne, swedes, turnip, and fodder beet). In the author's opinion many of the diseases might be prevented altogether or considerably diminished by disinfecting the seed before sowing, and the best preparations for this purpose are indicated, together with the proper doses and time of treatment. The use of home-grown seed is strongly recommended, in view of its commercial production being under State phytosanitary control. Spraying with Bordeaux mixture is recommended against the downy mildews of clover (*Peronospora trifolii hybridi* and other species) [*R.A.M.*, xiv, p. 241], lucerne (*P. aestivalis*) [*P. trifoliorum*: loc. cit., ibid., xi, p. 304], fodder beet (*P. schachtii*) [ibid., xv, p. 193], and other fodders, and against *Cercospora beticola* [ibid., xv, p. 285] on beet. Clover and meadow grasses grown for seed should be sprayed with lime-sulphur against *Erysiphe communis* [*E. polygoni*] and *E. graminis*, respectively [ibid., xiv, p. 572].

Schander (H.). **Ein Beitrag zur Physiologie der 'Kalkchlorose' der Lupine.** [A contribution to the physiology of 'lime-induced chlorosis' of the Lupin.]—*Ber. dtsch. bot. Ges.*, liii, 9, pp. 807–810, 1935.

Particulars are given of the writer's investigations at the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, Mark Brandenburg, on lime-induced chlorosis of lupins (especially *Lupinus luteus*, *L. angustifolius* being relatively insensitive to this type of injury) [*R.A.M.*, xv, p. 298]. It would appear from the data here presented that the disturbance arises only where the soil is excessively alkaline in the zone in immediate contact with the roots, and that the detrimental reaction may be adjusted in favour of the plants by means of their own root secretions provided the physical characters of the soil are reasonably propitious.

Pasinetti (L.) & Agustoni (Enrica). **Studio sulla definizione dei prodotti orto-frutticoli di scarto in rapporto a criteri fisiologici, fitopatologici e fitomerceologici.** [A study of the definition of unsaleableness in market-garden produce in relation to physiological, phytopathological, and phyto-commercial criteria.]—*Nuovi Ann. Agric., Roma*, xv, 4, pp. 561–684, 34 figs., 1935.

In this study of the standardization of fruit and vegetables carried out over a period of more than seven years at the Milan market and elsewhere, as well as in the laboratory, the authors specify the various grounds on which each kind of fruit or vegetable may be regarded as unfit for sale, and in each case give notes on the moulds and common fungal and other diseases liable to bring the produce into this category.

Shaw (L.). **Intercellular humidity in relation to fire-blight susceptibility in Apple and Pear.**—*Mem. Cornell agric. Exp. Sta.* 181, 40 pp., 3 figs., 8 graphs, 1935.

In these studies, a preliminary account of which has already been

noticed [*R.A.M.*, xiii, p. 451], the growth rate of the fireblight organism (*Erwinia amylovora*) [*Bacillus amylovorus*: ibid., xiv., p. 744] was tested in liquid culture with humidity equivalents produced by varying the concentrations of dextrose, levulose, sucrose, and maltose. Maximum growth occurred at 99·9 per cent. humidity equivalent; at 99·5, 99, and 98·5 per cent. growth was reduced to $\frac{3}{5}$, $\frac{1}{5}$, and $\frac{1}{10}$ of the maximum respectively, while at 98 per cent. only occasional very slight growth developed. In tests on solid media with relative humidities established over sulphuric acid solutions, the maximum growth was again at 99·9 per cent., reduced at 99 per cent. to $\frac{1}{3}$, at 98 per cent. to $\frac{1}{20}$, at 97 per cent. to a very slight growth or none, while at 96 per cent. no growth occurred. Pear fruits (Kieffer) and cut shoots (average of results on Kieffer and Bartlett) in equilibrium with different relative humidities showed maximum susceptibility at 100 per cent. relative humidity; at 99 and 98 per cent. susceptibility was, respectively, approximately $\frac{1}{6}$ and $\frac{1}{10}$ of the maximum, at 97 per cent. only very slight disease development occurred in a few cases, and at 96 and 95 per cent. no disease appeared.

A method is described for measuring the relative humidity in the intercellular spaces of living tissues, based on the turgor deficit of the plant cells. A table is given with the aid of which turgor-deficit values can be converted to equivalent relative humidities. Measurements on the above-mentioned shoots showed a relatively close agreement between the intercellular humidities and the humidities in the test chambers.

Potted pears (Kieffer and Bartlett) and apples (McIntosh and Delicious) at different atmospheric humidities and different soil moistures showed high susceptibility and high intercellular humidity when the moisture content of the environment was high, and vice versa. When the average intercellular humidity was between 97 and 98·5 per cent. the plants were completely resistant or only slightly susceptible, while when it was above 99·5 per cent. they were highly susceptible. Plants with intermediate intercellular humidities were intermediate in their degree of susceptibility.

Preliminary measurements on orchard trees showed significant daily variations in intercellular relative humidity, which was usually somewhat higher in Bartlett than in Kieffer pears, and in Yellow Transparent than in McIntosh apples.

It is concluded that intercellular humidity has a definite influence on fireblight susceptibility in apples and pears and is probably the main factor causing differences of susceptibility in comparable groups of plants in environments differing in the amount of moisture present.

Nose (T.). **A bark disease of Apple.**—*Ann. agric. Exp. Sta. Chosen*, vii, pp. 405–414, 2 pl., 1934. (Japanese.) [Abs. in *Jap. J. Bot.*, viii, 1, p. (21), 1936.]

Physalospora piricola, which is responsible for a severe and widespread disease of apple branches, leaves, and fruits (brown or grey, coalescent lesions) in Korea [*R.A.M.*, xiv, p. 640], was shown by cultural experiments to comprise three distinct strains.

Holz (W.). **Beobachtungen über Primärinfektionen durch Askosporen des Apfelschorferregers [Fusicladium dendriticum (Wallr.) Fckl.].** [Observations on primary infections by ascospores of the Apple scab agent (*Fusicladium dendriticum* (Wallr.) Fckl.)]—*Zbl. Bakt.*, Abt. 2, xciii, 13–17, pp. 290–295, 2 figs., 1936.

An examination in Berlin of 50 apple leaves boiled in potash lye revealed the constant presence in the centres of 264 so-called 'mycelial stars' (stellate thalli composed of a flat, pseudo-parenchymatous central mass whence branched hyphae radiate in all directions) of ascospores of the scab fungus (*Fusicladium dendriticum*) [*Venturia inaequalis*: *R.A.M.*, xv, p. 29], conidia being uniformly absent. These data are considered to substantiate the observations of American and European workers as to the primary importance of the ascospores in the initiation of scab epidemics [ibid., xiv, pp. 589, 590].

Hilitzer (A.). **Vliv strupovitosti na transpiraci Jablek.** [The influence of scab on the transpiration of Apples.]—*Ann. Acad. tchécosl. Agric.*, x, 5, pp. 616–621, 1 graph, 1935. [French summary.]

In the experiments briefly reported in this paper the author compared the daily loss in water under ordinary room conditions of normal apples with that of exactly comparable apples affected with scab (*Venturia inaequalis*), in relation to the final constant dry weight of the fruits. The results showed that the scabbed apples transpired considerably more (up to 3½ times as much) than healthy ones, the intensity of transpiration increasing with the size, the scabbed surface, and depth of cracks in the surface of the diseased fruits. Rotted and wormy apples, on the other hand, did not transpire appreciably more than healthy ones.

Hilitzer (A.). **Vliv strupovitosti na transpiraci Hrušek.** [The influence of scab on the transpiration of Pears.]—*Ann. Acad. tchécosl. Agric.*, xi, 1, pp. 118–121, 1936. [French summary.]

By methods similar to those used for scabbed apples [see preceding abstract], the author established that pear fruits heavily attacked by scab (*Venturia pirina*) always contain less water than sound ones, but not if only slightly affected. In both cases, however, the diseased fruits transpire considerably more (sometimes 20 times as much) than the normal, but no direct correlation was found between intensity of transpiration and size of fruit; usually, however, the increased transpiration of scabbed pears is relatively less than that of scabbed apples, this being attributed to the better developed cuticle in apples than in pears. Wormy pears do not transpire significantly more than the healthy.

Miller (P. W.). **A report of progress on studies of Prune russet ('scab') and its control.**—*Rep. Ore. St. hort. Soc., 1935*, pp. 105–122, 3 figs., 1 graph, 1936.

French and Italian prunes in Oregon and Washington are stated to suffer heavy damage from the disorder known as 'russet' or 'scab', which is widely distributed throughout the Pacific Northwest and may affect up to 75 per cent. of the crop; in 1935 the estimated incidence of the disease was 20 per cent. in Oregon and 10 in western Washington.

The fruit is disfigured by scattered, superficial, scurfy, yellowish-brown spots of varying shape and size, sometimes extending over three-quarters of the surface. The injury occurs relatively early in the season (beginning of May to early June), i.e., for about a month from the fall of the old calyces. Negative evidence having been obtained in attempts to isolate a pathogen from the diseased plums, the condition under observation may be definitely considered non-parasitic and probably largely due to mechanical abrasions of the young fruit by contact with twigs and branches during periods of high wind.

Baudyš (E.). **Nejdůležitější choroby a škůdci Meruňky a Broskvoně a ochrana proti nim.** [The most important diseases and pests of the Apricot and Peach, and their control.]—*Publ. fytopath. Sekce zemsk. výzk. Ust. zeměd.* [*Publ. phytopath. Sect. prov. agric. Exp. Sta.*] 147, Židlochovice, 55 pp., 60 figs., 1935.

This is a semi-popular, briefly annotated list of the more important physiological, bacterial, fungal, and virus diseases, and also pests, which are known to attack the apricot and peach in Czecho-Slovakia. Measures directed towards the control of the diseases are discussed rather fully in each individual case. Most of the figures illustrating this paper appear to be original.

Jones (L. K.) & Baur (K. E.). **Mosaic and related diseases of Raspberries in Washington.**—*Bull. Wash. St. agric. Exp. Sta.* 324, 19 pp., 9 figs., 1 map, 1936.

Virus diseases are stated to constitute a limiting factor in raspberry cultivation in the central and eastern United States [*R.A.M.*, xiv, p. 642] and to have caused serious losses in some of the Washington plantings [ibid., xii, p. 204], where mosaic is widespread and destructive, especially in the east. Yellow mosaic [see next abstract], leaf curl, and streak [ibid., xv, p. 163] are of minor importance. The crop is further affected by a physiological mottling in the shape of small, pale areas, scattered through the normal green tissue of fruiting canes and the older leaves of new ones; this disorder, which fluctuates from one season to the next, has no economic significance. Another condition liable to confusion with mosaic is a partial or subtotal chlorosis of the interveinal tissue of fruiting canes due to a disturbance in the metabolism of the plant.

The results of field observations showed that mosaic spreads more rapidly on black [*Rubus occidentalis*] than on red raspberries, of which Cuthbert is more susceptible than Marlboro in western Washington. The disease may be eradicated or reduced to a minimum by careful roguing. Several other red varieties, including Latham and Chief, are moderately resistant to mosaic, while Lloyd George is apparently immune. The Plum Farmer and Munger black raspberries suffer heavy damage from mosaic, Cumberland and others being less susceptible.

Control measures should include, besides thorough roguing, the use of sound nursery stock; the isolation of new plantings by at least 300 ft. from infected sites; the cultivation of resistant varieties in so far as these are commercially acceptable; and measures to prevent the introduction of infective aphids (*Amphorophora rubi*, *A. sensoriata*, *A. rubi-*

cola, and *Aphis rubiphila*) into healthy plantings on pickers' clothing or on crates and boxes.

COOLEY (L. M.). **The identity of Raspberry mosaics.**—*Phytopathology*, xxvi, 1, pp. 44–56, 1 diag., 1936.

Experimental transmission trials and field observations on disease spread in western New York afforded evidence that the 'mild mosaic' universally present in Columbian hybrid (purple) raspberries (*Rubus neglectus*) [*R.A.M.*, xi, p. 381] is caused by a virus identical with that of red raspberry mosaic [see preceding abstract].

In inoculation tests with this virus on healthy Plum Farmer and Cumberland black raspberries [*R. occidentalis*], the latter developed all forms of mosaic except the yellow type [loc. cit. and ibid., vi, p. 675] in varying degrees of severity from extremely mild to intensely virulent. It would thus appear that a single virus is capable of inducing all forms of mosaic (except yellow) liable to occur in the black raspberry in the eastern United States. These indications were substantiated by field experience, which further showed that the pathogenicity of the mosaic virus to *R. occidentalis* is largely governed by environmental, climatic, and cultural conditions. These data are considered to support Rankin's conclusion that only two viruses are involved in the causation of raspberry mosaic in the region under observation, viz., red and yellow [ibid., ix, p. 394].

Discussing the nomenclature of the raspberry mosaic viruses, the writer recommends the substitution for such inappropriate and confusing terms as 'red raspberry mosaic' and 'red mosaic' of the more descriptive 'green mottle' or simply 'green' mosaic, which conveys the entire range of symptoms from very mild to highly virulent cases. No change is proposed in the usage of the name 'yellow mosaic'.

WARDLAW (C. W.). **The storage and physiology of tropical fruits.**—*Trop. Agriculture, Trin.*, xii, 12, pp. 313–319, 2 graphs, 1935.

In the first part of this paper, read before the Imperial Botanical Conference, London, in 1935, the author discusses empirical storage problems of bananas, tomatoes, avocado pears, limes, and grapefruit, while the second part is devoted to the consideration of respiration in developing, maturing, and senescent fruits. In the measurement of the respiration of fruits in storage by the usual methods a time comes when the experiment has to be discontinued on account of fungal wastage, a sharp rise in the rate of liberation of carbon dioxide being characteristic of this phase. In this connexion a special study was made on the respiration of the papaw, a fruit especially favourable for the investigation of internal gas relations. When papaws have attained a certain degree of ripeness they develop spots due to *Colletotrichum gloeosporioides* [*R.A.M.*, vi, p. 57]. This fungus, however, is not a storage pathogen properly so called, but is established as a field infection which remains dormant for a time. The spots are circular, slightly sunken, and mostly superficial, and the chief damage done is the destruction of the epidermal and subepidermal tissues. Later, the spots serve as a means of ingress of other fungi.

In '**external**' respiration studies the first appearance of the spots was

found to be accompanied by a marked rise in the respiration rate, which continued to a striking degree as the spots spread. The generally accepted view of this is that the formation of carbon dioxide is due mainly to the active metabolism of the fungi which have become established, but in the papaw the destruction of the epidermal areas by the anthracnose fungus afforded a passage for increased leakage of the gas. Thus the increase in respiration rate coincident with the onset of wastage is chiefly referable to leakage through the partly destroyed epidermis under conditions of high internal carbon dioxide concentrations.

MEHRLICH (F. P.). **Pathogenicity and variation in Phytophthora species causing heart rot of Pineapple plants.**—*Phytopathology*, xxvi, 1, pp. 23–43, 1 fig., 1936.

Heart rot of the pineapple, associated in Hawaii with *Phytophthora parasitica*, *P. cinnamomi*, and *P. palmivora* (the two last-named in Oaku only) [*R.A.M.*, xiv, p. 604], has also been reported from Costa Rica (*Rev. Agric. Puerto Rico*, xxvi, p. 4, 1931), Jamaica [*R.A.M.*, xiii, p. 79], Porto Rico (*Rep. Porto Rico Exp. Sta.*, p. 31, 1905), Cuba [*R.A.M.*, iii, p. 346], and Queensland [ibid., xiv, p. 458], and also by growers from Haiti and the Philippine Islands. The writer's data as regards the distribution of the species of *Phytophthora* concerned in the etiology of the disease in Hawaii do not accord with those of Sideris and Paxton [ibid., x, p. 325].

The taxonomy of the heart-rotting pathogens is discussed and comprehensive evidence presented for the identification of *Pseudopythium phytophthoron* Sideris as a strain of *Phytophthora cinnamomi* Rands.

The occurrence in cultures of *P. cinnamomi*, *P. palmivora*, and *P. parasitica* of variations comparable to those recognized in the rusts as physiologic forms tends to invalidate the classification of *P.* spp. on the basis of differential susceptibility in a particular host. In this connexion the writer questions whether the separation of *P. cinnamomi* from *P. cambivora* [ibid. x, p. 754] is justified on the grounds of the differential symptoms induced by the two pathogens on potato tubers [ibid., x, p. 755]. The morphology of these two fungi being essentially similar, their combination as a single species, *P. cambivora*, comprising distinct strains, is suggested. A number of isolations of *P. parasitica* from rotted pineapples in Hawaii failed to grow, like *P. palmivora*, on maize meal agar at 35° C., so that Tucker's criterion of response to temperature [loc. cit.] for the separation of these two species does not appear to be altogether convincing.

A rot of green pineapple fruits was produced by inoculation with *P. cinnamomi* and *P. parasitica*, both of which were also pathogenic to radicles of *Ricinus communis*, the latter also attacking unwounded *Crotalaria incana*, *Richardsonia scabra*, and tomato seedlings; five local isolations of *P. cinnamomi* submitted to R. P. White [in New Jersey] for comparison with his *Rhododendron* strains [ibid., xii, p. 696] all proved capable of infecting the last-named host.

SERRANO (F. B.). **Pineapple yellow-spot in the Philippines.**—*Philipp. J. Sci.*, lviii, 4, pp. 481–493, 4 pl., 1935.

Pineapple yellow spot [*R.A.M.*, x, p. 474; xii, p. 304], first observed

in the Philippines (where it was probably introduced on infected planting material from Hawaii) in 1928, and found so far only on the Smooth Cayenne variety, ranks in importance locally next to fruitlet black rot [*Bacterium ananas*: ibid., xiv, p. 776] and mealy-bug wilt [ibid., xiv, p. 457].

The first symptom is a yellow spot 2 to 15 mm. in diameter, usually about 8 cm. distant from the base of a young leaf, the initial infection probably being carried upward from the base by the continued growth of the leaf. As a rule, only one leaf shows this spot, below which a yellow streak develops after a few days and extends down the base in the form of a water-soaked spot; under favourable conditions decay quickly sets in. Within a short time all the central leaves are affected; they become stunted, chlorotic, brittle, and tend to tighten together, the lower leaves remaining apparently normal. Diseased plants, when cut lengthwise, show patches of brown tissue in the stem round the attachment of the leaf that showed the initial spot. At this point the plant ceases growth and bends downwards.

Infection may occur at any time during the life of the plant, though it usually attacks young plants, causing dwarfing and ultimately death. Late infections are generally confined to the fruits and crowns. Infection may start from a flower or young fruitlet, in the same manner as in a young leaf, or it may begin in the crown of a young fruit. This type of infection results in malformation, dwarfing, yellowing, and rotting of a few 'eyes' of one side of the fruit, while the opposite side develops normally, forcing the fruit to bend towards the focus of infection. In advanced infections the fruit may become hollow, resembling the Kauai disease of Hawaii. All kinds of planting material are susceptible, suckers being least and crowns most liable to be affected.

Attempts to transmit the disease by mechanical means gave negative results [ibid., xi, p. 191], but transmission was successfully effected by larvae of *Thrips tabaci* [ibid., xi, p. 586] allowed to feed for over ten days on diseased pineapple plants and *Emilia javanica* and *E. sonchifolia* plants showing symptoms resembling yellow spot. The incubation period in the pineapple ranged from seven to twenty-five days. The disease was also transferred from the pineapple to healthy *Emilia* plants.

For purposes of control, clean cultural methods are indicated, while it is thought that insecticidal applications against the insect vector may also prove beneficial.

Taylor (G. G.). **Application of orchard-sprays. I. The stationary system.**—*N.Z. J. Agric.*, li, 6, pp. 321–329, 1935; lii, 1, pp. 34–38, 11 figs., 1936.

In this paper the author gives a general account of the stationary system of spraying orchards which was first introduced into New Zealand in 1925 and is now widely used throughout the Dominion [*R.A.M.*, xiii, p. 529]. The following points may be mentioned. The circulating system of piping has been abandoned in New Zealand in favour of the dead-end systems as the former requires more pipe and causes greater pressure loss. The underground position for the pipes has been found more advantageous than the overhead [ibid., xv, p. 28], or the laying of temporary mains on the soil surface [ibid., viii, p. 587].

Many of the systems in New Zealand have been installed with pipes too small in diameter; under average conditions the pressure loss in these systems may exceed 200 lb., or even 300 lb. in parts most distant from the pump. With larger pipes (1 or 1¼ in. diameter) the maximum pressure loss can be reduced to under 150 lb. without the cost of the pipes being excessive or the velocity of the spray being so reduced as to cause sedimentation. The maximum convenient length of hose is 120 ft. and the diameter (internal) ½ or ⅝ in.

To obtain relatively constant pressures at the nozzles the working pressure at the pump must be adjusted according to the parts of the orchard being sprayed, the amount of adjustment required being ascertained by means of a pressure gauge inserted between the hose and nozzle. To avoid accretion of spray materials in the pipes, the latter should be washed with water after each day's spraying.

The second part of the paper deals with the pumping station and discusses pump capacity, pressure and its adjustment, mixing tanks, agitators, engines, motors, reservoirs, and holding tanks.

Turnbull (J.). **Spraying.**—*J. Minist. Agric.*, xlii, 9, pp. 865–870, 1935.

In this article the author discusses some recent developments in spraying technique in England. The employment of higher pressures has permitted the use of shorter and more convenient lances, and in order to reach the tops of the higher trees a fixed double nozzle [*R.A.M.*, xiv, p. 114] has been placed on the market. The new equipment enables spraying operations to be carried through much more rapidly than formerly, but requires pressures of not less than 250 lb. per sq. in., while 400 lb. can be employed, especially for larger trees. The selection of the right type of pump is of fundamental importance, whether portable or stationary systems are used; the correct size may be calculated from the quantity of spray required to complete one spraying and the rate of working per hour necessary to effect this within the time allowed, provision being made for losses of pressure and of working time, amounting to the equivalent of one half of the rated capacity of the pump, as well as for the fact that 5 or 6 hours' actual spraying is the maximum that can be attained in a 9½ hours' working day. With the new equipment it is estimated a man can apply up to 2 or 3 galls. of spray per minute, and he can therefore spray two or three times as many trees a day while the effort required is less.

Schmidt. **Versuche zur Spritzung schwer benetzbarer Blätter mit Kupfermitteln.** [Experiments on the spraying of leaves difficult to moisten with copper preparations.]—*Blumen u. PflBau ver. Gartenwelt*, xl, 2, p. 20, 1 fig., 1936.

Neither home-made Bordeaux mixture nor the various commercial substitutes tested showed satisfactory adhesive properties when applied to the smooth, waxy leaves of cabbage and carnations, but very good results were obtained by the addition to the fungicide of 'tezet 10 S' which causes the formation of an almost continuous copper deposit over the sprayed surface.

CUNNINGHAM (G. H.). **Plant protection by the aid of therapeutants.**—xxvi+243 pp., 4 pl., 2 figs., 19 diags., 2 graphs, Dunedin, New Zealand, J. McIndoe, 1935.

In his preface the writer states that the present work aims at supplying, in encyclopaedic form, the latest available information (up to 1935) on the use of therapeutics in the control of bacteria, fungi, and insects attacking plants and the products thereof. The book is divided into six sections, viz., (I) sprays and spraying; (II) dusts and dusting; (III) fumigants and fumigation; (IV) disinfection of seeds, tubers, bulbs, and corms; (V) soil disinfection; and (VI) miscellaneous, each of which is subdivided into chapters as the treatment of the subject requires. Incorporated in the work is the information published by the writer from time to time in the *New Zealand Journal of Agriculture*, while assistance in various sections is acknowledged from E. E. Chamberlain, W. Cottier, J. G. Gibbs, J. C. Neill, G. G. Taylor, and others. The treatise forms a most compact and comprehensive account of modern plant protectives and makes an effective contribution to the literature of the subject which will no doubt be welcomed by phytopathologists, fruit-growers, and farmers alike. Interesting features of the work are a glossary of the scientific terms used in the various sections and a 26-page bibliography.

Le cinquantenaire de la bouillie bordelaise. [Fiftieth anniversary of Bordeaux mixture]—Supp. to *Rev. Path. vég.*, xxii, pp. 1–72, 3 figs., 1935.

In this supplement, commemorating the work of Millardet, the discoverer of Bordeaux mixture, a series of papers on the fungicide is communicated by various authors. Prof. P. Dangeard (pp. 10–16) deals with the scientific work of Millardet. J. Dubaquié (pp. 17–32) gives a historical outline of the events which led Millardet, in association with Gayon, to advocate the use of copper against vine mildew (*Plasmopara viticola*). L. Ravaz (pp. 33–40) describes the chief modifications that have been made in the formula of the mixture from time to time and refers to the extended use of the fungicide. J. Capus (pp. 41–8) discusses the influence of weather conditions on outbreaks of vine mildew and black rot (*Guignardia bidwellii*) [*R.A.M.*, xiv, p. 557] and emphasizes the importance of studying local climatic factors in relation to the moment of infection rather than in relation to the date of the appearance of the symptoms. E. Foëx (pp. 49–55) deals with the use of Bordeaux mixture against potato blight (*Phytophthora infestans*). M. Raucourt and J. Barthelet (pp. 56–60) summarize our present knowledge on the chemistry of the fungicide. MM. Trouvelot and Dixmeras discuss combined treatment of potatoes against Colorado beetle [*Leptinotarsa decemlineata*] and blight. The last-named authors suggest that when the insect attack occurs early in the season the first treatment should be purely insecticidal, but if late, a mixed treatment should be given. Applications made during the summer (at periods when either blight or the beetle threaten to develop) and late summer (if required) should also be mixed. Good results were obtained with a dust containing 11·5 per cent. arsenic (as calcium arsenate) and 8 per cent. copper.

EVANS (A. C.) & MARTIN (H.). **The incorporation of direct with protective insecticides and fungicides. I. The laboratory evaluation of water-soluble wetting agents as constituents of combined washes.**—*J. Pomol.*, xiii, 4, pp. 261–292, 2 pl., 1 diag., 3 graphs, 1935.

This is a tabulated account of the results obtained in a preliminary investigation of the possibility of using laboratory methods for testing the efficacy, as wetting agents for insecticidal and fungicidal sprays, of the numerous chemical compounds that have recently been suggested for this purpose. The substances tested, namely, sodium oleate, igepon T (powder), sulphonated lorol, C 72, agral 2, C 75, agral N, crude calcium gamma-sulphonates, sodium resinate, saponin, gelatine, and sulphite lye were used as aqueous solutions in a simple small-scale apparatus consisting essentially of an atomizer, a pressure regulator, and a device for regulating the volume of spray applied; this device consisted of a large screen with a rectangular aperture in it, attached to a pendulum swinging between the atomizer and the surface sprayed, the volume of spray applied being regulated by the number of times the aperture in the screen swung directly across the centre of the spray cone. The spraying was done on standardized artificial surfaces, either simple cellulose lacquers to simulate the leaf surfaces, or shellac to represent easily wetted insect surfaces; glass plates and strips were dipped in these preparations, after which they were allowed to drain and dry for 18 hours before use. The amount of spray retained by the sprayed surfaces was determined either by direct weighing of the plates and slides before and after treatment, or by estimating, in the case of cupric sprays, the amount of copper retained. For the determination of the area of spread, drops of known volume (0·06 ml.) of the solutions were delivered from a small capillary tube on to thin glass plates coated with films of cellulose nitrate or acetate, or shellac. The contact angles were measured by the plate method suggested by Adam and Jessop, and surface tensions by the drop volume method.

The results of the work indicated that all the substances investigated may be arranged in the same rough general order of activity as wetting agents by their various physical properties examined, namely, spray retention, area of spread, contact angles, and surface tension. A high correlation was shown to exist between the wetting property (i.e., the ability of a liquid to form a persistent liquid-solid interface when excess of liquid is drained from the surface) and the receding contact angle of the spray, perfect wetting resulting when this angle is zero. Spreading properties may be assessed by the estimation of the area of spread which is determined by the advancing contact angle, but which, in solutions of similar advancing contact angle that were tested, was found to be greater with spreaders of long-chain structure. The maximum amount of spray initially retained upon the standard surface held at right angles was determined by the wetting and spreading properties, and decreased with increased wetting and spreading ability. The receding and advancing contact angles of the solutions exhibited a high correlation, with the exception of saponin solutions. It was further found that, except for these correlations, the determination of any one characteristic is insufficient to give a general assessment of the wetting

and spreading properties. There was, however, an indication that with materials of similar molecular structure it may be possible to deduce generalizations on the behaviour as a spray spreader and wetter from a limited number of characteristics which can be determined in the laboratory.

FREEMAN (E. M.). **Phytopathology—and its future.**—*Phytopathology*, xxvi, 1, pp. 76–82, 1936.

After briefly touching on the history of phytopathology and defining its scope, the writer attempts a forecast of its future, which is discussed with special reference to the increasing complexity of the problems involved, the need for specialization and at the same time for co-ordination with allied branches of science, the practical side of plant disease control, the mutual obligations of Federal and State departments and phytopathologists, and the inclusion within an autonomous professional guild of representatives of the scientific, teaching, technical, and practical aspects of plant pathology.

FOISTER (C. E.). **The relation of weather to fungous and bacterial diseases.**—*Bot. Rev.*, i, pp. 497–516, 1935.

The writer has extended and amplified his previous survey (1929) of the outstanding literature on the correlation between weather and plant diseases [*R.A.M.*, ix, p. 259], the bibliography here appended on which comprises 129 titles. The subject, introduced by a brief general statement, is discussed under the headings of epidemiology, antecedent factors, disease initiation and epidemics, physiological specialization, and fundamental research, and illustrated by appropriate examples of problems engaging the attention of phytopathologists in different parts of the world.

SĂVULESCU (T.). **Protectia plantelor si organizația fitopatologică in România.** [Plant protection and phytopathological organization in Rumania.]—*Publ. Inst. Cerc. agron. României* 19, 64 pp., 9 figs., 1 graph, 1935.

This is a Rumanian version of the author's German account of the organization and functioning of the plant protection service in Rumania published in 1934 [*R.A.M.*, xiv, p. 49]. Details are given of new orders that have appeared since the publication of the earlier version, including one, dated 4th Oct. 1934, regulating the production, movement, and sale of seeds and nursery stock within the country.

STEPANOFF (K. M.). Распространение инфекционных болезней растений воздушными течениями. [Dissemination of infectious diseases of plants by air currents.]—*Bull. Pl. Prot., Leningr.* 8, 2nd Ser. (*Phytopathology*), 68 pp., 4 figs., 1 graph, 1935. [English summary.]

After a review of the literature dealing with the dissemination by the air of infectious plant diseases, the author gives a full account of laboratory experiments and field observations in Leningrad and its vicinity on the factors involved in the process. Tests with various fungi, including *Monilia sitophila* [*R.A.M.*, xiii, p. 7], *Botrytis cinerea*,

Helminthosporium sativum, *Cunninghamella* sp. [ibid., xiv, p. 655], *Fusarium moniliforme* [*Gibberella moniliformis*], *F. scirpi* var. *acuminatum* [ibid., xiv, p. 409], *F. culmorum*, *Colletotrichum lini* [see above, p. 369], *Ustilago tritici*, *Puccinia triticina*, *P. coronifera* [*P. lolii*], and *Phytophthora infestans*, showed that while the spores of one group (e.g., *U. tritici*, *M. sitophila*, *B. cinerea*, and others) are very easily detached from the sporophores and carried away by the lightest air currents, those of another group, such as the aecidiospores of rusts, and the conidia from the aerial mycelium of *Fusarium* spp., are separated and carried through air with difficulty, and those of the third group, including *C. lini* and the conidia from *Fusarium* pionnotes and sporodochia, are not disseminated at all in the air. The great majority of the pathogenic fungi belongs to the first two groups (collectively termed anemochores), and those of the much less numerous third group (which includes many members of the Sphaeropsidales) depend for their distribution on the agency of animals (zoochores), water (hydrochores), and other mechanical means. It was also found that the spores may be carried upwards and distributed to short distances by slight convection air currents.

The rate of dropping of the spores was tested in Ukkelberg's apparatus [*R.A.M.*, xii, p. 498] and the rate of soaring in a special apparatus, termed the sporostat, in which spores were allowed to fall upon an upward current of air and observed through a beam of light. The results showed that in still air the spores dropped at very variable rates, depending on the size and on the individual differences of the spores.

In special open-air tests, in which spore masses of *Tilletia tritici* [*T. caries*] either alone or in mixture with *Bovista plumbea* spores were artificially disseminated and caught on glass slides at various places, it was shown that the settling down of the spores at different points from the centre of dissemination is governed by a law which may be expressed by the equation $y = c + \frac{a}{sx}$, where y is the distance between the source of spore distribution and the point of the settling down of the spores, x is the number of spores that have alighted per unit of area and per unit of time, s is the area of spore settlement investigated, and a and c are constants dependent on the special conditions of the test. By means of this equation it is possible to construct 'isospores', i.e., lines connecting the points where equal numbers of spores settle down around the focus of distribution.

In evaluating the danger presented by a given source of infection to crops and plants more or less distant from it, consideration should be given to the following factors: the ease of detachment of the inoculum from its substratum; the viability of the inoculum; the intensity of its dissemination through space; the abundance of the inoculum at its source; obstacles (mountains, hills, forests, and the like) to dissemination; size of the plant surfaces liable to infection (acreage and density of susceptible plant stands); 'limit norms' of air contamination with the spores (i.e., the maximum number of spores that alight per time unit and surface unit, unable to induce an economically important outbreak of the disease under the local ecological conditions); and the

environmental conditions (temperature, humidity, wind velocity, and so forth) at the infection focus and at the place of possible infection. By combining the data thus obtained, it will be possible to delimit zones outside which the given infection focus becomes inoperative in causing economically important disease outbreaks.

Ho (W. T. H.) & Li (L. Y.). **Preliminary notes on the virus diseases of some economic plants in Kwangtung Province.**—*Lingnan Sci. J.*, xv, 1, pp. 67–78, 11 figs., 1936. [Chinese summary.]

Investigations on the following virus diseases of plants occurring in Kwangtung Province, China, are described in this paper.

Infected peppers (*Capsicum* spp.) show a faint mottling of the leaves [*R.A.M.*, xiii, p. 219; xiv, p. 215], accompanied as a rule by general stunting of the plants. In extreme cases the leaves assume a filiform shape and papery texture. The disease was transmitted from infected to healthy pepper plants by means of sap, and mosaic symptoms were further produced on two *Capsicum* plants by inoculation with tomato mosaic virus.

Papaw mosaic [ibid., xi, pp. 26, 625] involves a puckering, upward curling, stunting, and yellow interveinal discoloration of the foliage, followed by desiccation and shedding. Badly diseased leaf blades are abnormally small with much shortened petioles and the size of the fruit is also greatly reduced.

A relatively mild virus disease of *Crotalaria saltiana*, extensively cultivated locally as a green manure, is characterized by foliar discoloration and poor seed.

Cucumbers in the Canton district display the typical foliar symptoms of Johnson's cucumber mosaic virus 3 [ibid., xiv, p. 811], with the addition of local or general chlorosis of the fruits.

Figs (*Ficus carica*) are liable to a form of mosaic [ibid., xv, p. 305] manifested by a pale yellow, generally somewhat indefinite mottling of the leaves, sometimes accompanied by necrosis and malformation.

Tomato mosaic is prevalent in Canton, causing up to 90 per cent. infection in the field and involving the local growers in immense losses in 1934, and has also been observed in Fukien Province, Shanghai, Nanking, Hangchow, and Peiping [Pekin]. Cross-inoculation experiments with the virus on tobacco, pepper, potato, and cucumber resulted in 0, 60, 100, and 100 per cent. infection, respectively, indicating a relationship with the cucumber virus rather than with that of tobacco, though unlike the former it was not inactivated by ten minutes' heating at 80° C. or by two month's ageing. Inoculations were successful both by means of needle pricks and aphid feeding, young plants infected during December and January generally responding by more pronounced filiform or 'fern-leaf' symptoms [ibid., xv, p. 181] than those inoculated in March or April. Other symptoms include foliar bunching, mottling, crinkling, and marginal dentation, and the development on the fruits of characteristic yellow and deep green patterns. Pruning with a contaminated knife was found to disseminate infection. Suspected insect vectors of the disease are the cucumber beetle (*Ceratia orientalis Hornst.*) and *Epilachna 28-punctata* Fabr. Varietal reaction tests indicated that Peachblow, Burpee, and Sutton's Best of All are

immune from mosaic, while Sutton's Prince of Wales and Money Maker may show up to 100 per cent. infection; a fair degree of resistance (10 per cent.) was manifested by Sutton's Perfection, Kondine Red, Ponderosa, Super Standard Bonny Best, two types of Earliana, and Walker's Recruit.

Typical features of mulberry mosaic [ibid., xiii, p. 219] are chlorosis, puckering, a papery consistency, malformation, and torsion of the leaves. Local methods of cultivation afford excellent opportunities for the natural transmission of the disease, which was also experimentally effected by grafting. The related paper mulberry (*Broussonetia papyrifera*) has been found to suffer from a similar disturbance.

Tobacco mosaic appeared in a characteristic form in a nursery plot at the Kwangtung Provincial Bureau of Agriculture and Forestry. The disease has further been observed in Hopeh Province and is believed to be co-extensive with tobacco cultivation in China.

Bean (*Phaseolus vulgaris*) mosaic [see above, p. 341] has been found to attack eleven local varieties. Four out of ten seedlings raised from the seed of a diseased plant gave indications of mosaic. The virus infecting Lima beans (*P. lunatus* var. *macrocarpus*) induces a much more diffuse mottling than that on *P. vulgaris*.

Florida High Bush eggplants are liable to severe infection by a typical mosaic causing stunting, discoloration, and distortion of the foliage and reduction in size of the fruits [ibid., xv, p. 202]. The indigenous Pak and Hung varieties appear to be resistant.

Potato mosaic symptoms are more conspicuous under Kwangtung conditions during the winter. The virus is transmissible to tomatoes.

Sugar-cane mosaic [see below, p. 398] and mosaic of maize were also observed [ibid., ix, pp. 300, 724, and above, p. 346].

Ryjkoff (V. L.). Вирусные болезни растений. Общая и частная вирология. [Virus diseases of plants. General and specific virology.]—247 pp., 62 figs., 3 graphs. Госуд. Издат. колх.-совх. Литер. "Сельхозгиз" [State Publ. Off. Lit. collect. co-op. Farming 'Selkhozgiz'], Leningrad, 1935.

In the first part of this monograph the author [who transliterates his surname Rischkow] gives a concise survey of the progress attained in recent years in the study of filterable viruses causing disease in plants (with incidental reference to those of man and animals), mostly compiled from the results obtained by workers in other countries. After discussing the theories already advanced regarding the nature of viruses, he suggests that these agencies may be a chemical substance (or substances) of the nature of an enzyme which, when introduced into an host cell, induces the latter to elaborate ever accumulating amounts of the same substance, this explaining the apparent multiplication of the virus in living host tissues. The different chapters of this general section deal with the morphological, anatomical, and cytological changes produced by the viruses in the host plants; the physiology of the virus diseases, including the effect of environmental conditions on their development and external expression; methods of transmission; movement of the virus in host tissues; susceptibility and immunity of the plants; geographical distribution of the diseases; control measures;

classification of the viruses; and methods generally used for the description of the diseases.

The second part consists of a more or less detailed account from literature of all the virus diseases so far known of useful and ornamental crops, arranged by the hosts, the greatest space being given to the diseases of the potato, tomato, and tobacco. The bibliography at the end of the volume covers 20 pages.

MANIL (P.). **L'étude sérologique des maladies à virus des végétaux.** [The serological study of plant virus diseases.]—*C.R. deuxième Congr. Sci., Bruxelles*, pp. 998–1004, 1935.

In this address, delivered at Brussels in June, 1935, the author succinctly reviews and discusses the most recent advances in the serological study of filterable plant viruses. Practically all the work referred to has already been noticed in this *Review*.

BOTJES (J. G. O.). **De stand van het immuniteitsvraagstuk bij virusziekten van de planten.** [The status of the immunity problem in virus diseases of plants.]—*Tijdschr. PlZiekt.*, xlii, 1, pp. 1–9, 1936.

The present position of the problem of immunity in relation to virus diseases of plants is discussed, with reference to current studies on the subject in Europe and the United States, under the following headings: selection of attenuated virus strains [*R.A.M.*, xiii, p. 179]; whether such strains arise spontaneously under given environmental conditions or by selection from already existing strains [ibid., xiii, p. 330]; acquired immunity [ibid., xiv, p. 812]; the range of immunity from specific virus diseases [ibid., xi, p. 750; xii, p. 581]; and observations in connexion with the question of immunity from virus diseases in potatoes in Holland.

VANDERWALLE (R.). **Quelques caractères physiologiques de différentes souches de Verticillium du groupe dahliae.** [Some physiological characters of different strains of *Verticillium* of the *dahliae* group.]—*Bull. Inst. agron. Gembloux*, iv, 4, pp. 378–398, 1 fig., 1935. [Flemish, German, and English summaries.]

After describing the cultural behaviour of six strains of *Verticillium dahliae* [see above, p. 370] from potato, rose, orchid, tomato, aster [*Callistephus chinensis*], and chicory [*Cichorium intybus*] on Raulin's agar at P_H 6·8, the author records the growth characters of the three latter strains on Raulin's liquid medium adjusted to different P_H values and also on the agar by using a method similar to that devised by Labrousse and Sarejanni [*R.A.M.*, ix, p. 549]. The results indicated the presence of physiological differences which cross inoculations showed did not amount to definite specialization. When each of five of the strains (the orchid strain being omitted) was inoculated in turn into all the hosts, yellowing and slight wilting was produced, the organism being reisolated in every case.

On Raulin's medium the tomato, chicory, and aster strains rapidly acidified the medium, which reached a maximum of P_H 3·7 to 4 whatever the initial value. The tomato strain produced rapid acidification followed by an equally rapid return to alkalinity and reaching P_H 8 to

8·4 after 28 days. The chicory strain produced slow, very slight acidification and a correspondingly slow decline in acidity which did not fall below P_H 5·4. The aster strain caused rapid but slight acidification, the medium quickly returning to its initial P_H value. In tests of the effect of these strains on the oxy-reduction potential no change was apparent.

Experiments with the tomato and rose strains on Richards's medium with different nitrogen constituents showed that with nitrogen as potassium nitrate acidification in general increased slightly but fell back rapidly, whilst with ammonium chloride the P_H fell rapidly to 3·1 without return towards alkalinity, and with ammonium the P_H was hardly altered.

Elpidina (Mme O. K.). **On toxins of wilting.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., iii, 8, pp. 360–364, 1935.

In the experiments outlined in this paper the author tested the wilting effect on cut clover and potato leaves, and sweet clover and tomato seedlings of the toxins extracted by two different methods, the first based on Richter's method (*Dipp. on. Acp. K.-B.* [*J. exp. Agric. S.E.*], 1929) and the second that used by Schaffnit and Lüdtke [*R.A.M.*, xii, p. 314], from the solid and liquid substrata of pure cultures of a species of *Fusarium* which causes a potato wilt in Russian Central Asia. The results [which are tabulated] showed that while the four hosts tried differed from one another in their reaction to the different toxin preparations, the greatest wilting effect on all of them was exerted by those solutions that contained the largest amount of ammonia. The same toxin solutions were unable to cause any wilting of the plants tested after the ammonia had been removed from them. These findings indicate that the toxic principle of the toxin solutions is ammonia, and the conclusions of the German authors are considered to be vitiated by the fact that methyl alcohol, used by them for extraction, is a good solvent for a number of ammonium salts, this warranting the belief that their toxin preparations were fairly highly concentrated solutions of ammonium salts.

Salgues (R.). **Les modifications biochimiques en phytopathologie. Sur les substances hydrocarbonées de la feuille d'Ampelopsis veitchii hort.** [Biochemical modifications in phytopathology. On the carbohydrate content of the leaf of *Ampelopsis veitchii* hort.]—*C.R. Soc. Biol., Paris*, cxx, 40, pp. 1212–1214, 1935.

Both in healthy foliage of *Ampelopsis veitchii* [*Parthenocissus tricuspidata*] and in that displaying the dingy brown, circular lesions of *Phyllosticta allescheri* in the Midi (south of France), soluble polysaccharides were observed to increase steadily from 10th August to 15th October, while the insoluble polysaccharides declined during the same period; from 15th to 30th October there was a rapid diminution of soluble sugars and a slight decrease of insoluble carbohydrates in both healthy and diseased leaves. There is thus no essential difference in the chemical processes undergone by the two series of experimental material, the sole distinction lying in the much slower rate at which they were accomplished in the infected foliage. The latter retained its green

colour and remained attached to the branches after the healthy leaves had fallen. These data are considered to bear out the results of previous studies on the same lines indicating the existence of a parallel between juvenility and a pathological state of the tissues [*R.A.M.*, xv, p. 116].

BALDACCI (E.). **Ricerche intorno alla cosidetta vaccinazione nelle piante.** [Researches on the so-called vaccination of plants.]—Reprinted from *Atti Ist. bot. Univ. Pavia*, Ser. IV, vii, 58 pp., 1 fig., 1935. [Latin and English summaries.]

After reviewing the literature on acquired immunity [*R.A.M.*, xiv, pp. 713, 783] the author describes in detail a number of inoculation experiments [the results of which are fully tabulated] on rice seedlings vaccinated by growing them in culture filtrates or mycelial extract of *Sclerotium* (*Corticium*) *rolfsii*, *S.* (*C.*) *centrifugum*, and *S. oryzae* Curzi's strain, strain II, and strain I.M.I. (= *Leptosphaeria salvinii*), [ibid., xv, p. 313], the filtrates being diluted to 1 in 10, 1 in 50, and 1 in 100 and the mycelial extract to 1 in 100.

In the first experiment, seedlings grown in culture filtrates and inoculated with *S. rolfsii*, *S. centrifugum*, and *S. oryzae* strain II showed, respectively, 50, 60, and 7·6 per cent. mortality, as against 90, 100, and 25 per cent. in the corresponding controls, but after 20 days only the plants grown in the filtrate of *S. centrifugum* showed a lower mortality than the controls. This result might be taken to indicate that the vaccinations had exerted a temporary immunizing effect, but if the figures relating to the other two strains of *S. oryzae* are included and the data arranged according to the dilution of the extract it is found that 63, 40, and 33·3 per cent. of all the plants grown in culture solutions diluted 1 in 10, 1 in 50, and 1 in 100, respectively, and inoculated with the respective fungi, were killed within ten days, as compared with 43·7 per cent. in the controls; of the plants treated with the mycelial extract only 3·2 per cent. were then dead. By the 20th day all the effects of the vaccinations had disappeared, there being 93·3, 80, 84·8, and 77·4 per cent. dead plants for the three dilutions and the mycelial extract, respectively, as against 68·7 per cent. in the controls.

In a second series of experiments, seedlings inoculated with *C. rolfsii* and *S. oryzae* strain Curzi and strain II and grown in their respective culture filtrates died before the controls, while with *S. oryzae* strain I.M.I. the vaccinated plants and the controls died on the same day; with *C. centrifugum* the plants vaccinated at a dilution of 1 in 100 showed more resistance to infection than the controls.

When the plants were left exposed to the vaccines for an indefinite period (without inoculation) after 30 days, 41, 41·6, 53·8, 53·8, and 61 per cent. of those vaccinated with *C. rolfsii*, *S. oryzae* strain II, *C. centrifugum*, *S. oryzae* strain I.M.I., and *S. oryzae*, Curzi's strain, respectively, were dead, or arranging the data according to the dilution of the vaccine, 71, 40, and 13·3 per cent. were killed at dilutions of 1 in 10, 1 in 50, and 1 in 100, respectively. The mycelial extract was responsible for 68 per cent. mortality in the same period.

These results show that the vaccines produced a toxic effect after the plants had been exposed to them for an appreciable period, and that the mycelial extract is more toxic than the culture filtrate. The difficulties

of interpreting the results of experiments on plant vaccination are discussed and many errors are pointed out. The author concludes from the results of his studies and those of earlier investigators that plant vaccination has not yet been definitely established.

Bawden (F. C.) & Pirie (N. W.). **Experiments on the chemical behaviour of Potato virus 'X'.**—*Brit. J. exp. Path.*, xvii, pp. 64–74, 1936.

A tabulated account is given of a series of experiments [the technique of which is described] to determine the effects of certain enzymes on purified suspensions of the S strain of potato virus X, which produces local necrotic lesions and systemic symptoms in the shape of necrotic spots and rings in infected White Burley tobacco plants [*R.A.M.*, xv, p. 172]. The virus was inactivated by eight hours' contact at P_H 7 and 38° C. with a 0·15 per cent. solution of Merck's pancreatin, containing about 90 per cent. lactose, the inactivating factor being soluble in petrol ether. The addition to the suspensions of trypsin immediately reduced the infectivity of the virus without affecting the flocculating property with antiserum, whereas crystalline trypsin at 0·05 per cent. destroyed both these properties after three hours' incubation at P_H 7. Neither papain nor cyanide alone exerted any effect on the virus, which was inactivated, however, by a combination of the two (0·17 per cent. of each) at P_H 4 after an incubation period of 5 hours 10 minutes. Used at a strength of 1·1 per cent., nitrous acid completely destroyed the infectivity of the virus in one hour at hydrogen-ion concentrations above P_H 4·8 without impairing its capacity for flocculation with antiserum.

The fact that virus X, unlike tobacco mosaic and certain animal viruses, is rapidly inactivated in the presence of certain proteolytic enzymes cannot be regarded as conclusive proof that this infective principle contains protein [ibid., xiv, p. 721], for even the crystalline preparations of enzymes may contain substances besides trypsin or pepsin, but taken in conjunction with other features of the virus the data here presented are regarded as highly suggestive. Possibly the strongest evidence for the presence of protein in virus X is that afforded by the experiments with papain, which remained inactive towards the virus until contact with cyanide provided the necessary stimulus.

Köhler (E.). **Über die Variabilität des Ringmosaikvirus (X-Virus) der Kartoffel.** [On the variability of the ring mosaic virus (X virus) of the Potato.]—*Naturwissenschaften*, xxiii, 49, pp. 828–830, 1935.

The writer's observations at Berlin-Dahlem are stated to have confirmed those of J. Johnson and Koch in respect of the divisibility of potato ring mosaic [*R.A.M.*, xv, p. 247] into two types, namely, potato ring spot and mottle virus [ibid., xiv, p. 523], of which the latter is characterized by a superior degree of thermostability. Each type comprises strains of varying virulence. To the ring spot virus belong, for instance, the following strains previously isolated by the writer: Mb 12 from Magnum Bonum, E 1 from Erdgold, and H 19 and M 23 from Kl. Sp. Wohltmann [ibid., xiv, p. 388], of which Mb 12 is the least pathogenic (virtually latent) and M 23 the most. The mottle virus was detected

principally in the Erstling (Duke of York) variety and was found to fall into three strains, Erstl. 34, 25, and Mix, of which the first is semi-latent and the third the most virulent. All three have shown a fair degree of constancy. Further evidence was obtained of the protective action of one virus against another [loc. cit.]. E 1 exerted an immunizing action against M 23 but not Erstl. 25, and Erstl. 34 against Erstl. 25 but not against Mb 12 or H 19.

Of the two types under discussion, the ring spot (as already shown by Böhme) [ibid., xiii, p. 319] is much the more virulent, being successfully inoculated by rubbing into the Erdgold, Parnassia, and Paul Krüger [President] varieties, but not into Ackersegen, while none reacted positively to the mottle virus. Another important difference between the ring spot and mottle viruses lies in the presence in the former of a number of subtypes which are conspicuously absent from the latter, or rather are represented only by quantitative variations in virulence. Thus, Duke of York plants yielded a strain, Cs, which produces on inoculation into tobacco a well-defined tortoise-shell pattern. In conclusion attention is drawn to the frequent occurrence in tobacco, and probably also in potato, of mixtures of virus types and subtypes in which one partner ultimately gains the upper hand and so creates a false impression of spontaneous changes in the virulence or nature of the type. In Duke of York, for example, the tortoise-shell virus, with its powerful penetrative capacity, may in certain strains usurp the place of the original mottling principle.

KÖHLER (E.). **Fortgeführte Untersuchungen über den Kartoffelabbau.** [Continued investigations on Potato degeneration.]—*Landw. Jb.*, lxxx, 3, pp. 379–408, 1936.

Continuing his studies on the etiology of potato degeneration in Germany, the writer gives a comprehensive, tabulated account of the results of an examination of Silesian consignments of the Erdgold and Stärkereiche [Starchy] varieties, among which the following viruses were observed: leaf roll, streak or Y mosaic, different varieties of the X virus [see preceding abstract], a relatively thermolabile virus, provisionally termed 'P', readily transmissible to tobacco by means of the juice and presumably belonging to the Y category, and slight mosaic infections of an indeterminate character, mostly non-transmissible to tobacco. The P virus causes on tobacco seedlings a slight mosaic which later disappears, while on plants in the field no mosaic symptoms are produced but the leaves show a tendency to roll upwards; these symptoms are not specific, but the virus can be recognized by the characteristic indefinite yellow discoloration along the veins resulting from mixed infection with the X virus.

An analysis of the yield data in greenhouse and field tests indicated that leaf roll and streak are virulently infectious to Erdgold, the Starchy variety also suffering severely from the first-named, while even the comparatively mild forms of mosaic exerted a detrimental effect on tuber production in greenhouse trials with Erdgold cuttings.

Wartenberg's and Hey's electrometric method of determining the value of tubers for seed [*R.A.M.*, xv, p. 171] proved to be applicable only to early maturing varieties such as Erstling [Duke of York], the tuber

potential in the case of the later sorts (Erdgold and Starchy) remaining virtually uninfluenced by the virus infections.

BLATTNÝ (C.). **Ozdravovací pokus se sortou Bramborů 'Pražské rohlíky'.** [An attempt to restore the health of the Potato variety 'Pražské Rohlíky'.]—*Rec. Inst. Rech. agron. Rép. tchécosl. 1935*, 137, pp. 33–38, 1935. [German summary.]

The author states that by strict selection of potato seed-tubers from apparently healthy plants, and by roguing out of all virus-diseased plants from the fields at the first appearance of symptoms, he succeeded, after eight years' work, in reducing infection in the variety 'Pražské Rohlíky' (which is highly esteemed locally) from 90 to 3 per cent. The work has now been abandoned, however, owing to the high susceptibility of this variety to infection with different viruses [see next abstracts] as well as to wart disease [*Synchytrium endobioticum*]. Comparable results were also obtained in similar work during seven years with the variety Blauäugige, closely related to the British Arran Victory, and it is being prosecuted further owing to the high wart resistance and excellent commercial qualities of this potato.

BLATTNÝ (C.). **Příspěvek k léčení virových chorob Bramborů.** [Contribution to the therapy of the virus diseases of the Potato.]—*Rec. Inst. Rech. agron. Rép. tchécosl. 1935*, 137, pp. 39–42, 1935. [German summary.]

The experiments briefly reported in this paper consisted in cutting tubers of the local Modraky potato variety, affected with various viruses, into two halves, one of which was injected with 1 c.c. of either insulin (50 units), albumin, asparagin, d-arginin carbonate, histidin (each 2 per cent.), or four other substances, and the other was planted untreated. During the first season a certain qualitative but not quantitative reduction was noticed in the virus diseases [see next abstract] (especially leaf roll) in the plants raised from the halves treated with some of the preparations, but these differences were for the most part only transient and were obliterated later in the season. No differences at all were observed in the next season in the progeny of the treated and of the untreated halves, indicating that the treatment had no lasting effect on the virus content of the tubers.

BLATTNÝ (C.). **Pokus o vlivu závlahy a vlivu doby sázeni na zdravotní stav Bramborů.** [Experiments on the influence of watering and of the date of sowing on the health of Potatoes.]—*Rec. Inst. Rech. agron. Rép. tchécosl. 1935*, 137, pp. 43–47, 1935. [German summary.]

Comparative experiments in 1933 and 1934, in which tubers of a virus-infected line of Erstling [Duke of York] potatoes were used, showed that virus diseases (leaf roll [see preceding abstract], crinkle, mosaic, and stipple-streak) were considerably masked, and the yield of the plants was increased by 15·2 per cent. in the plots which were watered from above at regular intervals. The spread of the diseases in these plots was also reduced by 13·6 per cent. of that of non-watered plots. These results are chiefly attributed to the reducing effect of

watering on the number of infective aphids, the averages being 322 aphids per stool in the non-watered and 258 in the watered plots. Experiments on the control of the aphids by applications to the growing plants of derris and pyrethrum powder gave promising results.

Collateral experiments in the same years showed that the spread of the virus diseases was further reduced by 24 per cent. by sowing the diseased tubers in summer time instead of in the spring, this being attributed to the same cause as that mentioned above, since the average population of aphids per stool was 289 in the spring and 56 in the summer of 1933.

Köck (G.) & Greisenegger (K.). **Tätigkeitsbericht des Kartoffel-Fachausschusses über das Jahr 1935.** [Report on the work of the Potato Expert Committee for the year 1935.]—*Neuheiten PflSch.*, xxviii, 6, pp. 164–167, 1935.

A summarized account is given of the activities of the Austrian Potato Expert Committee during 1935 [cf. *R.A.M.*, xiv, p. 464]. Attempts to combat wart disease [*Synchytrium endobioticum*] by means of soil treatments [ibid., xv, p. 112] with various types and amounts of sulphur were a complete failure in contrast to the promising results given by similar experiments in the previous year. It appears probable, however, that the disease will gradually decrease in intensity, and perhaps disappear altogether with the exclusion from the fields of susceptible varieties, and a tendency in this direction is in fact already manifest. Of 95 selected strains from various localities tested for their reaction to *S. endobioticum* in the laboratory, 59 proved to be susceptible.

Three applications of 1 per cent. Bordeaux mixture controlled *Phytophthora* [*infestans*] in the Alma and Hindenburg varieties, the increases of yield in the former amounting to 21, 34, and 18 per cent., respectively, in the plots sprayed at the rates of 20, 15, and 10 l. per sq. m. Out of 67 varieties tested for their behaviour in respect of late blight and tuber rot, 47 were affected by both manifestations of *P. infestans* and only one was resistant to both.

Blattný (C.). **Příspěvek k poznání hlenky Bramborové.** [Contribution to the knowledge of powdery scab of Potatoes.]—*Rec. Inst. Rech. agron. Rép. tchécosl. 1935*, 137, pp. 21–25, 5 figs. (at the end of the fascicle), 1935. [German summary.]

On the occasion of an exceptionally heavy outbreak of powdery scab (*Spongospora subterranea*) [*R.A.M.*, xiv, p. 525] of potatoes which occurred in 1934 in various regions of Czecho-Slovakia, especially on acid and waterlogged soils with relatively high rainfall, the author observed certain morphological, histological, and ecological differences between the form of the disease that developed abundantly on the root system and less frequently on the underground part of the [main] stems (very rarely on the stolons), and that on the tubers. On the former the swellings produced are numerous, small, and wart-like, the spore balls are formed in any of the tissue layers, are yellowish-brown in colour, and measured 26·4 to 62·05 μ (average 48·5 μ), while on the tubers the swellings are isolated, scab-like, and disintegrating, the spore balls

are chiefly subcuticular, greyish-brown in colour, and 26·4 to 77·5 μ (average 52·1 μ). The root form, however, did not apparently affect adversely the general health and yield of the plants, and in three out of 30 attempts it was induced to infect potato tubers, on which the usual form was reproduced. Whilst not specifically distinct, therefore, the two forms are separated by the author, the root form under the name *S. subterranea radicicola* and the tuber form as *S. subterranea tubericola*. It is further suggested that the root form may be rather a mycorrhizal than a parasitic fungus, the solution of this question being left for further investigation.

RODE (A.). **Zur Frage des Kartoffelschorfes.** [On the question of Potato scab.]—*Dtsch. landw. Pr.*, lxiii, 1, p. 4, 1936.

Pending the development of potato varieties combining immunity from scab [*Actinomyces scabies*] with other desirable qualities, the most practical method of combating the disease in the clay soils of North Hanover appears to lie in rational crop rotation [*R.A.M.*, xiii, p. 51], allowing a minimum of five, and preferably six, years to elapse between one potato crop and the next and interposing, for instance, fallow, oats, swedes, summer barley, and oats.

MILLER (J. C.). **The developing and growing of certified seed Potatoes for subtropical and tropical countries.**—*Amer. Potato J.*, xiii, 1, pp. 9–10, 1936.

Louisiana potato-growers desirous of raising stock for certified seed for export to southern countries, such as Cuba, must first procure from a northern State certified seed, the foundation stock of which has already given satisfaction in Louisiana. Before planting, the potatoes must be treated for surface diseases, e.g., scab [*Actinomyces scabies*]. At four to six weeks old the crops are officially inspected for virus diseases [cf. *R.A.M.*, xv, p. 248], of which mild and rugose mosaics are the most prevalent under local conditions. On lifting, the potatoes are transported in 100 lb. sacks to cold storage at 38° to 40° F., where they remain until ready for shipment, prior to which they are again inspected and certified by a Federal official.

BRAUN (H.). **Alternaria solani als Parasit der Kartoffelknolle.** [*Alternaria solani* as a parasite of the Potato tuber.]—*NachrBl. dtsch. PflSchDienst*, xv, 12, pp. 10–111, 3 figs., 1935.

Alternaria solani, hitherto regarded in Germany exclusively as a potato leaf parasite [*R.A.M.*, x, p. 202; xv, p. 246], has recently been found to cause a typical dry rot of the tubers, a similar phenomenon having also been observed, according to a written communication from Dr. Roth of Crefeld, in Belgium [ibid., xiv, p. 679]. The fungus was isolated from infected Erstling [Duke of York] tubers and successfully inoculated into healthy ones of the same variety; in the case of Wohltmann the reaction was less intense. The fact that *A. solani* is included among the pathogens to be considered in relation to the certification of Dutch seed potatoes is a further indication of its growing importance as a tuber parasite.

HINO (I.). **Antagonistic action of soil microbes with special reference to plant hygiene.**—*Trans. third int. Congr. Soil Sci.*, i, pp. 173–174, 1935.

The author has shown that potatoes remain healthy in the presence of soil protozoa notwithstanding inoculation by *Bacillus aroideae* [see above, p. 346], while they wilted in a few days in the absence of protozoa. The latter were inactivated, however, by large amounts of inoculum and also by extremes of temperature. Other plant pathogens destroyed by protozoa were *Bacterium* [*Pseudomonas*] *hyacinthi* [*R.A.M.*, xv, p. 298], *Bact.* [*P.*] *citri* (82 and 72 per cent., respectively, in four days), *Fusarium* sp., and *Penicillium* sp. (12 and 18 per cent., respectively, in 24 hours). *B. aroideae* is further liable to attack by a number of soil bacteria, including *B. prodigiosus*, *B. proteus*, and *B. megaterium* [ibid., xv, p. 140]. Nakata found in Fukuoka, Japan, that *Bact. solanacearum*, the agent of tobacco wilt [ibid., xv, p. 180], is frequently killed by the admixture with the culture of *B. mycoides*, *B. fluorescens*, *B. cereus*, *B. proteus*, and *Azotobacter chroöcoccum*, while Endô's experiments in the writer's laboratory revealed the extreme antagonism of *B. prodigiosus* and other bacteria to *Hypochnus centrifugus* [*Corticium centrifugum*: ibid., xiv, p. 719]. The last-named, *H.* [*C.*] *sasakii* [ibid., xiv, p. 795], and *Sclerotium oryzae* [*Leptosphaeria salvinii*: see above, p. 389], incorporated in a loamy soil, were all destroyed in five days by *Bact. lactis*. A number of soil fungi (including actinomycetes) were also found by Nakata to prey upon *Bact. solanacearum* and by Endô to infest *C. centrifugum*, but in general the action of these organisms is less potent than that of the bacteria. *Trichoderma lignorum*, however, was ascertained by the writer to be highly destructive to *Sclerotinia libertiana* [*S. sclerotiorum*], *C. centrifugum*, and *C. sasakii* [cf. ibid., xiv, p. 739], and a pathogen of this type is more suitable for the control of harmful parasites than are protozoa, the abundant presence of which is liable to induce soil sickness.

BLATTNÝ (C.) & VUKOLOV (V.). **Nakažlivá neplodnost Chmele.** [Infectious sterility of the Hop.]—*Rec. Inst. Rech. agron. Rép. tchécosl. 1935*, 137, pp. 3–18, 17 figs., 1935. [German summary.]

An account is given of the authors' studies since 1924 of the 'hereditary' or infectious sterility of hops [*R.A.M.*, vi, p. 692; xi, p. 624] in Czecho-Slovakia. The macroscopic symptoms, to the untutored eye, are indistinguishable from those of temporary sterility which occasionally affects during one or two years some hop plants, while even those that are apparent to the expert, e.g., delayed development of seasonal growth, weaker reaction of the affected plants to manuring, mottled, darker green or chlorotic, and malformed foliage, shortened internodes, failure of the lower stem buds to develop, and profuse and irregular development of the apical shoots, the growing points of which are soon killed, and the like, are often deceptive, and are reminiscent of other diseases, chiefly of virus origin [a brief description of which is appended]. The only reliable external sign of the disease is the more or less complete sterility of the affected hop plants during three consecutive years, which explains why the diseased plants are practically never removed from

hop gardens before at least the fourth year. The disease is distributed over all the country, and the average incidence is estimated at about 0·3 per cent. of the plants.

Microscopically the disease is characterized by the extensive phloem necrosis of all the non-lignified organs, and especially of the growing points, where the necrosis is particularly deep-seated and appears before the differentiation of the tissues. The necrosis was also observed in the leaf petioles and the main veins of the leaves. It is typified by a swelling of the cell walls; phloem parenchyma in the neighbourhood of the vessels may also be affected, and the vessels, though not attacked themselves, may be filled with a granular substance. The roots and woody parts of affected plants do not show pathological changes, except that the phloem in the immediate vicinity of the undeveloped basal buds on the bines may also be necrotic.

The disease could not be transmitted experimentally by mechanical methods, through the soil, or by insects, but it was readily transmitted by grafting, both from diseased stock to the scion and vice versa; cuttings taken from affected plants were invariably diseased. All the characters described are considered to indicate that the disease is caused by a virus, the origin of which is not known; the possibility is suggested that it may result from the splitting up of some complex virus of the hop, certain evidence suggesting that it may have originated from the dissociation of the virus of the 'kadeřavost' disease [loc. cit.].

Azevedo (N.). **Nota sobre um lichen prejudicial ao Guaco (Mikania scandens L.).** [A note on a lichen harmful to Guaco (*Mikania scandens* L.).]—*Rodriguésia*, i, 3, pp. 33–34, 3 pl., 1935.

Mikania scandens, a medicinal plant growing in the Botanical Gardens, Rio de Janeiro, was observed to show a heavy leaf infection by the lichen *Strigula elegans* Fée & Müll. f. *hirtella* Müll. Arg., the upper leaf surfaces being almost completely covered with pustules 3 to 5 mm. in diameter. Infection on the lower surfaces was less intense.

To prevent infection it is recommended that the plants should be grown in places where they receive direct sunlight; affected plants should be sprayed with 2 per cent. Bordeaux mixture.

Pal (B. P.) & Nath (P.). **Phyllody : a possible virus disease of Sesamum.** —*Indian J. agric. Sci.*, v, 4, pp. 517–522, 4 pl., 1935.

Sesamum indicum [*S. orientale*] plants at Pusa are every year affected by a condition known as 'phyllody' and recorded elsewhere as 'green flowering' disease [*R.A.M.*, viii, p. 355; xii, p. 748]. Affected plants bear flowers in which all the floral members except the stamens are transformed into leaf-like organs or show a marked tendency to become leafy. The stamens seldom contain functional pollen and the plants may be completely sterile. The condition may begin with the first flower, all subsequent flowers then becoming affected, or it may occur later, in which case the flowers formed previously are normal, but the tips of the branches and main axis and the new growth from the base are phylloid. Shortening of the upper internodes always occurs, so that the abnormal flowers are crowded together; the foliage leaves are dwarfed, and in the floral region they may be pale. Phylloid flowers

are radially symmetrical. Glandular hairs are found in parts where they are normally absent, while varieties which normally develop only one flower in each leaf axil show three flowers per axil. The calyx is polysepalous, and the primary veins of the sepals are thick and prominent; the apices of the petals are rounded. A fifth (anterior) stamen is usually developed, while the ovary is enlarged, the style is reduced, and the carpellary wall transformed into two foliaceous structures.

Attempts to transmit the disease by sap inoculations gave negative results. But when four pairs of sesame plants (each consisting of one normal and one phylloid plant) were reciprocally grafted, three weeks later in one graft the originally normal scion showed signs of the condition, while in the other three all the new branches produced by the originally healthy stock bore phylloid flowers. This result suggests that the disease is systemic and may be due to a virus. Some evidence was obtained that early sowings develop a larger proportion of affected plants than late ones.

Matsumoto (T.) & Yamamoto (W.). **On the perfect and imperfect stages of the fungi causing Sugar-cane diseases.**—*J. Plant Prot.*, xxiii, pp. 9–14, 107–115, 7 figs., 1936. [Japanese.]

Leptosphaeria sacchari, the agent of ring spot of sugar-cane [*R.A.M.*, xiv, p. 397], was found to produce abundant pycnidia of a species of *Phyllosticta* besides the perithecia on certain culture media as well as on the natural lesions, thereby substantiating the genetic connexion between the perfect and imperfect stages observed by Bourne in Florida [ibid., xiv, p. 57].

Helminthosporium stenospilum [ibid., xiv, p. 530], the causal organism of brown stripe, produces on culture media an ascigerous stage agreeing with that described by Carpenter from Hawaii as a species of *Ophiobolus* [ibid., xi, p. 4], but the writers propose the transference of this species to Drechsler's newly established genus *Cochliobolus* [ibid., xiv, p. 125], characterized by a helicoid ascigerous stage and *Helminthosporium* conidia, as *C. stenospilus*.

The ascigerous stage developing in cultures from 'pokkah-boeng' tissues closely resembles *Gibberella moniliformis* [see above, p. 346] and *G. fujikuroi* [ibid., xiv, p. 709], while the imperfect stage approximates to *F. moniliforme* var. *subglutinans* [*G. fujikuroi* var. *subglutinans*: see above, p. 359] in the production of conidia in false heads.

McIntosh (A. E. S.) & Stevenson (G. C.). **Gumming disease investigations in Barbados.**—*Bull. Brit. W. Ind. centr. Sug. Cane Breed. Sta.* 8, 17 pp., 1 graph, 1935.

A summary is given of the results of the gumming disease of sugar-cane (*Bacterium vasculorum*) [*R.A.M.*, xv, p. 317] investigations carried out from 1929 to 1935 in Barbados [ibid., xiv, p. 531]. It appears from the results of reaction tests that nearly all the seedlings derived from crosses between *Saccharum spontaneum* and *S. barberi*, when crossed with members of the species *S. officinarum*, are resistant to the disease. The last-named species was further found to comprise a fair percentage of varieties showing resistance to gumming under local conditions. For

instance, seedlings originating from B. 1379, including B. 6835, B. 417, S.C. 12/4, Ba. 8069, and the female parent of B.H. 10 (12), are markedly resistant. So far, none of the 'noble' cane crosses has yielded progeny with an entire absence of leaf symptoms, and the development of absolute immunity within this group appears scarcely probable, though it is likely that types with sufficient resistance for commercial purposes may ultimately be evolved. The fact that canes, even of susceptible varieties, are rarely killed by *Bact. vasculorum* in Barbados, suggests the possibility of an attenuated degree of virulence in the strain occurring under local conditions in the Island. [A summary of the information here presented is also given in the Report of the Station for the year 1935.]

LUTHRA (J. C.) & SATTAR (A.). **Some observations on the mosaic disease of Sugarcane in the Punjab.**—*Indian J. agric. Sci.*, v, 6, pp. 649–662, 1935.

In the Punjab, sugar-cane affected by mosaic [*R.A.M.*, xiv, p. 257; xv, p. 315, and next abstract] has so far only shown the primary symptoms, no dwarfing or cracking of the stem having yet been observed. The first symptoms occur about 1½ months after planting and continue to develop until October when, as the cane matures, the symptoms become rather obscure. The incidence of mosaic on a number of varieties grown in the years 1927 to 1933 is recorded; the results indicated that while the degree of infection varies from place to place, the varieties Uba, Treru, and Co. 223 were almost totally infected, S. 48, Co. 205, 210, 262, 270, 309, and 349 had more than 20 per cent. infection, and Co. 214, 227, 231, 232, 233, 238, 243, and a number of other varieties were not affected. Three years' field tests showed that on the Co. 223 variety the disease does not significantly reduce the yield of cane, juice, or raw sugar or the quality of the juice. Roguing appears to keep the disease in check only on those varieties that show some resistance.

RAFAY (S. A.). **Physical properties of Sugarcane mosaic virus.**—*Indian J. agric. Sci.*, v, 6, pp. 663–670, 1935.

Using a standardized method of inoculation (by means of 20 entomological pins mounted in a cork pricked through sap into the leaf), the author found that the sugar-cane mosaic virus [see preceding abstract] tolerates a dilution of 1 in 10 but not 1 in 100. The virus loses its potency in two hours, and filtration experiments showed that it was retained even by filter paper, the filtrate being non-infective. Copper sulphate, 1 in 1,500; hydrochloric acid, 1 in 1,000; nitric acid, 1 in 800; hydrogen peroxide, 1 in 25; and formalin, 1 in 50 inactivated the virus; while zinc powder did not affect it. Evidence was obtained that dilute concentrations of the reagents may increase the virulence of the virus.

SYDOW (H.). **Novae fungorum species—XXIII.** [New species of fungi—XXIII.]—*Ann. mycol., Berl.*, xxxiii, 5–6, pp. 367–384, 1935.

Latin and English diagnoses, supplemented by critical notes, are given of 15 new species of fungi collected in Chile, India, Java, the

Philippine Islands, Latvia, and Sweden [cf. *R.A.M.*, xi, p. 474]. *Calendula officinalis* leaves in Latvia bore conspicuous, confluent lesions, 0·5 to 2 cm. diameter, with yellowish-green, later dirty brown centres bordered by a discoloured yellow zone; the depressed-globose pycnidia are 70 to 110 μ in diameter and the hyaline, oblong or oblong-cylindrical uniseptate conidia measure 12 by 3 to 3·5 μ, and are rounded at both ends. The causal organism is named *Ascochyta calendulae* n. sp.

The pale yellow to yellowish-green, elliptical, shrivelled rust (*Melampsora*) spots on willow (*Salix caprea*) leaves [ibid., xv, p. 74] are parasitized by *Colletotrichum socium* n. sp., characterized by rod-shaped to cylindrical conidiophores, 6 to 10 by 2·5 to 3 μ, and oblong to cylindrical or elongated to ellipsoidal, sometimes clavate, straight or slightly curved, continuous, hyaline conidia, rounded at the apex, tapering towards the base, 12 to 20 by 4·5 to 6 μ.

CHABROLIN (C.). **Le cycle évolutif des Urédinées. Revue des travaux sur l'hétérothallisme des Urédinées.** [The evolutionary cycle of the Uredineae. A review of the work on the heterothallism of the Uredineae.]—*Ann. Serv. bot. Tunis*, xi, pp. 273–283, 1935.

In this paper the author gives a succinct account, based on a study of the relevant literature, of the biological and genetical data establishing the existence of heterothallism in the Uredineae [cf. *R.A.M.*, xiii, p. 318 *et passim*], these data then being considered in the light of recent cytological investigations of the fungi concerned. The paper concludes with a short discussion of the importance of the whole question to mycology and phytopathology, and there is a bibliography of 33 titles.

Перечень вредителей и болезней растений внешнего карантина, установленных для СССР. [List of insect pests and diseases prohibited by external quarantine legislation from importation into the U.S.S.R.]—*Publ. НКЗ СССР, Сект. внешн. к внутр. Каранп. Растений* 2 [*U.S.S.R. People's Commissariat Agric. Sect. intern. extern. Pl. Quar.* 2], Moscow, 47 pp., 1935.

This is the full official list of the insect pests and plant pathogenic bacterial and fungal organisms, the introduction of which into the U.S.S.R. or into new regions of the Union is prohibited by the 1935 plant quarantine regulations [*R.A.M.*, xv, p. 127]. It is divided into three groups, the first of which comprises all the more dangerous organisms still unrecorded from the country, and includes *Bacterium* [*Pseudomonas*] *citri* (the quarantine against which includes all species and varieties of *Citrus* from countries where the disease is present), *Synchytrium endobioticum* (the entry of all susceptible hosts from infected countries is prohibited), and *Phlyctaena linicola* on flax [but see ibid., xi, p. 45].

The second group comprises organisms doubtfully present or of limited distribution within the U.S.S.R. Their host plants are not absolutely debarred from entry into the country, but the presence of any of the organisms on a single specimen entails the rejection or even the destruction of the whole consignment. These organisms are *Bact.* [*P.*] *citriputeale* on oranges, lemons, and tangerines; *Aplanobacter michiganense* on tomatoes; *Bact. flaccumfaciens* on beans (*Phaseolus vulgaris*

and *P. lunatus*); *Bact. medicaginis* var. *phaseolicola* on beans; *Bacillus amylovorus* on all the susceptible hosts; *Bact. translucens* and *Bact. atrofaciens* on cereals; *Bact. mori* on mulberry; *Sclerotium rolfsii* on all its hosts; *Phoma lingam* on crucifers and beet; *Spongospora subterranea* [ibid., xii, p. 589; xiv, p. 330] on potato and tomato; *Sporotrichum citri* on *Citrus*; *Dibotryon morbosum* on stone fruit trees and material; *Endothia parasitica* on chestnut, oak, maple, *Garya*, and *Rhus* spp.; *Phymatotrichum omnivorum* [ibid., xi, p. 42] on all of its numerous hosts; *Ceratostomella fimbriata* on species of *Ipomoea*; *Macrophoma edulis* on sweet potato; *Diplodia tubericola* on its hosts; *Fusarium batatatis* [*F. bulbigenum* var. *batatas*] on sweet potato; *F. hyperoxysporum* on sweet potato; *Tilletia pančičii* on barley; *T. horrida* on rice; *Urocystis tritici* on wheat; *Uromyces betae* on beet [ibid., xii, p. 560].

The third group consists of organisms the presence of which on imported plants requires the disinfection of the whole consignment which may be directed to certain ports of entry, as regulated for each individual case, namely: *Bacterium tumefaciens* on all of its known hosts; *Fusarium conglutinans* on cabbage, asters, turnips, and beet; *Sorosporium reilianum* on maize and sorghum; and *Urocystis cepulae* on all species of *Allium*.

In every case the world distribution of the organisms, so far as it is known, is fully indicated.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, vii, 10, pp. 212–217, 1935.

Esthonia. A Decree of 9th October, 1935, defines the nature and scope of the measures to be taken with a view to combating plant diseases and pests and the duties of heads of institutions, agricultural and horticultural establishments, and the like, and of landowners on whom the execution of the necessary work of eradication and control devolves. The Minister of Agriculture is empowered to make orders for the carrying out of this Decree. The Order of 1932 requiring the destruction of buckthorn [*Rhamnus cathartica*] and barberry [*Berberis vulgaris* and its var. *atropurpurea*; *R.A.M.*, xii, p. 800] is hereby superseded.

British Honduras. Statutory Rules and Orders. 1936, No. 15. Proclamation prohibiting the importation of Grapefruit and Orange plants, except under certain conditions—2 pp., 1936.

This proclamation provides that the importation of citrus plants into British Honduras shall only be effected through the Department of Agriculture, the selection of the nursery from which any plants are obtained being in the discretion of the Agricultural Officer. Trees of each consignment after planting shall be open to inspection at any time, and within three years the owner may be required to destroy or spray any tree affected by any harmful disease believed to have been introduced thereon. All material used in packing is to be burnt after unwrapping the trees at their destination.